ENGINEERING
LIBRARY

SEP 20 1948

American Foundryman

THE FOUNDRYMEN'S *Own* MAGAZINE . . .

SEPTEMBER
1948

MOORE RAPID

Lectromelt

FOREHEARTH FURNACES

reduce production headaches

Manufactured in

CANADA	Lectromelt Furnaces of Canada, Ltd., Toronto 2
ENGLAND, SWEDEN, AUSTRALIA	Birlec, Ltd., Birmingham, England
FRANCE	Stein et Roubaix, Paris
BELGIUM	S. A. Belge Stein et Roubaix, Bressoux-Liege
SPAIN	General Electric Espanola, Bilbao
ITALY	Forni Stein, Genoa

The lack of uniformity and poor quality of much of present day raw materials is making the production of high-grade, uniform gray iron extremely difficult. The new Lectromelt Forehearth furnace is the complete answer to this situation.

Lectromelt's Forehearth is an especially designed direct arc type furnace for operation in conjunction with cupolas or air furnaces. It provides high quality metal by:

1. Closely controlling temperature by providing an efficient, readily controllable source of heat.
2. Controlling analysis by additions or refining operations or both.
3. Providing a reservoir or holding capacity for the dual purpose of leveling off the peaks of the demands from the pouring floor and assuring a more uniform analysis by proper mixing.

A Lectromelt Forehearth furnace can help you out of a tough situation. Write today for descriptive literature.

Lectromelt furnaces are made in capacities ranging from 100 *tons to* 25 *pounds.*

PITTSBURGH LECTROMELT FURNACE CORP.

PITTSBURGH 30, PENNSYLVANIA

NEW FOUNDRY TREND *Leads to* BETTER CASTINGS

THERE IS A NEW trend in the foundry industry. All of us have been exposed to it and all of us will have to keep up with it. It is forcing new terminology into our shop talk whether we like it or not. It is revising ancient concepts and it will teach us to produce better castings.

What is this trend?

The answer can be given best by directing your attention to the variety of information that comes from participating in meetings of foundrymen and from reading foundry literature. Take special note of the increasing attempts to align the facts in terms of engineering fundamentals. There is a growing realization that descriptions of the art must be supplemented and replaced by scientific analysis.

Be prepared for discourses on fluid flow and heat transfer. The latter has already attracted the attention of many foundrymen who now attend Convention sessions on heat transfer in numbers over 200. A few years ago when A.F.S. heat transfer studies were initiated the sessions were attended by less than 50.

Recognize that coefficient of thermal conductivity, lamellar flow, and even integration of sine x are members in good standing of the foundry language.

Voices sometimes are heard at the Convention bemoaning the dearth of "practical" papers. What could be more practical than an attempt to bring order through mathematical analysis into the thoughts on, say, the feeding of castings? Be patient: today's equations are tomorrow's tables! Engineers without any apology use the latter after the former is forgotten.

Foundry management recognizes the state of affairs. This is evident in the support of courses to train engineers in foundry technology at colleges throughout the country. These fellows are good for the industry as translators of the scientific jargon. Be ready to use them. Take advantage of their background which will eventually enable them to interpret foundry technology in terms of castings production.

Remember, however, that while these neophytes are well equipped with useful tools, the tools need sharpening by contact with foundry veterans and foundry problems. Also, contrary to common belief, these college boys need a period in which to gain confidence—to get their feet on the foundry floor.

A challenge as real as a tough casting job faces the foundryman of today. He must keep up with the times. He cannot afford any longer to look with disdain on theory. Able to provide in his own foundry, examples of present methods which ten years ago were "impractical," today's foundryman must appreciate that todays foundry theory is tomorrow's foundry practice.

Charles Locke

CHARLES LOCKE
Vice-Chairman
A.F.S. STEEL DIVISION

Charles Locke is director of foundry research for Armour Research Foundation, Chicago. Born in Philadelphia, he went to Michigan College of Mining and Technology, Houghton, from which he received a B.S. degree in metallurgy in 1936. In 1937, he received a Master of Science degree from Rensselaer Polytechnic Institute, Troy N.Y. For the following year he was assistant metallurgist at Dodge Steel Co., Philadelphia, and in 1938 he began his association with West Michigan Steel Foundry Co., Muskegon, as metallurgist. Named chief metallurgist the following year, he was given additional duties as general superintendent in 1947. Mr. Locke was a member of the Western Michigan Chapter until he went to Armour early this year.

Colonial Foundries in the New World

Paul Revere & Son,

At their BELL *and* CANNON FOUNDERY, *at the North Part of* BOSTON,

CAST BELLS, of all sizes; every kind of Brass ORDNANCE, and every kind of *Composition Work, for* SHIPS, &c. *at the shortest notice*; Manufacture COPPER into SHEETS, BOLTS. SPIKES, NAILS, RIVETS, DOVETAILS, &c. from *Malleable Copper.*

They always keep, by them, every kind of *Copper softening for Ships.* They have now on hand, a number of Church and Ship Bells, of different sizes; a large quantity of Sheathing Copper, from 16 up to 30 ounce; Bolts, Spikes, Nails, &c of all sizes, which they warrant equal to English manufacture.

Cash and the highest price given for old Copper and Brass.

march 10

"Colonial Foundries in the New World" is taken from the forthcoming A. F. S. publication DEVELOPMENT OF THE METAL CASTINGS INDUSTRY by Bruce L. Simpson. Tracing the casting of metals from prehistoric times to the present, the book brings out the romance of the industry while showing that progress was made only as fast as research and equipment permitted. "Colonial Foundries in the New World" describes the establishment of early American foundries and the part they played in the Colonies at peace and at war.

Virtually no foundry developments differing materially from those previously brought forth in Europe and Great Britain can be found in the Americas prior to 1800. However, the tremendous increase in the use of castings which developed in this country after that date makes it imperative to trace the growth of the infant industry in the Western Hemisphere.

Prior to colonization of the Atlantic seaboard of the United States and Canada by the English, Dutch and French in the sixteenth and seventeenth centuries, castings had been produced by the native inhabitants, but not generally in North America. The North American Indians had no knowledge of metallurgy, according to present research, except for some facility with the cold working of copper.

Prehistoric American Foundrymen

There is some evidence that the prehistoric mound builders, who preceded the Indians, might have carried on some work with melted metals. The mounds located in what is now Ohio and the Mississippi Valley have yielded certain castings. Undoubtedly the same crude methods were employed as were used by the prehistoric peoples of the Middle East.

For all practical purposes, however, the New World was only beginning to emerge from the Stone Age when the white men first landed on these shores, bringing with them their knowledge of cast metals. Such was not the case, of course, with the more advanced native civilizations of Central and South America, where in Peru, Colombia and Mexico intricate examples of gold and silver castings have been discovered. It seems quite clear that the inhabitants of those areas already had developed for themselves the lost-wax method of molding, for in no other way could some of the complicated cast pieces attributed to them have been made.

Gold, however, was the primary metal; there is no evidence of the use of iron. As a result, the civilization of the South and Central American areas was restricted for, as we have seen, the foremost sign of a fully progressive people lies in the melting and casting of iron or alloyed non-ferrous metals. Without these, apparently, no civilization has ever progressed far.

Records indicate that, as a general rule, this hemisphere was explored for gold but colonized with iron. Iron first made its appearance as a result of a deliberate search by Sir Walter Raleigh, who advised of the finding of iron ore deposits on Roanoke Island in South Carolina. Samples were sent back to England, but no action was taken on their development for nearly forty years. In 1607 the first colony at Jamestown, Virginia, was established, and again iron was sent back for analysis.

It was not until 1622 that there was an actual attempt to make use of this mineral. In that year an iron blast furnace was established at Falling Creek, Virginia, near Richmond, with skilled melters and foundrymen from England—an enterprise that was completely wiped out by an Indian massacre prior to the time the furnace went into operation. Since none lived to tell

An Indian massacre at Falling Creek Furnace, Va., in 1622 wiped out the first blast furnace in the Colonies.

Joseph Jenks exhibits the first iron casting made in America, the famous "Saugus Pot."

Charging a blast furnace by hand from a bridge. Although this is a later furnace, the principle of charging the furnace is similar to that used in Colonial days.

what happened, details of the project are not known.

It fell to Massachusetts to have the honor, in 1642, of becoming the birthplace of the first American casting, the famous "Saugus Pot." This original American foundry was established near Lynn, Massachusetts, on the Saugus River, and has been referred to in history as the Saugus Iron Works. Some details of this operation give us a picture of the typical iron foundry of the American Colonial period.

The Saugus Iron Works

The founders of the enterprise were well-matched partners. Thomas Dexter, the mechanic and builder, was a rash and outspoken man of direct action. In 1863 we find him sentenced to sit in stocks for "seditious talk." His partner, Robert Bridges, the exact antithesis, was a pious and exemplary man and promoter of the project.

It was Bridges who took samples of Saugus area bog ore to England and obtained the necessary financial help for starting operations. Thus was founded the company known as "The Company of Undertakers for the Iron Works," with capital of £1000, which founded the small village of Hammersmith, so called because the imported furnace and foundrymen came from the town of Hammersmith, England.

On the fourteenth of October, 1642, a grant was made to the company which is of great interest to present-day foundry operators, as it indicates the extent to which government can go in encouraging private enterprise. Saugus Iron works was granted the exclusive right to make iron for twenty-one years, during which time it could freely mine ore, cut wood, dam streams and set up furnaces, and was given public lands on which to operate tax free. The firm was allowed to sell and transport freely, and all employees were completely exempt from military duty of any sort. Members of the company could even stay away from church without losing their voting privileges!

With such a start the company built a four-sided hollow stack 20 feet high, 24 feet square at its base, 6 feet in diameter at its top and with an interior diameter of 10 feet. The blast was operated by a water wheel which could not operate in freezing weather; thus no winter operations were possible. Bog ore dug from neighboring swamps was charged into the furnace, together with oyster shells for flux and charcoal for fuel. Capacity was estimated at eight tons of iron a week.

It is interesting to note that the first metal of the new plant was made into a casting. The company had retained one Joseph Jenks as master molder, who molded a cooking pot in a small mold buried in a hole in the ground, the resulting casting weighing about three pounds, with an internal diameter of about 4½ inches. Fortunately this "Saugus Pot" casting has been preserved and now is the property of the city of Lynn.

Working Conditions in the Colonies

Thus was ferrous casting on this continent commenced a little over three hundred years ago. It introduced an industry which was destined to grow in importance until, as a basic part of our economy, it now represents an investment of billions of dollars, a source of employment for millions and a supplier, either directly or indirectly, of most of our daily needs.

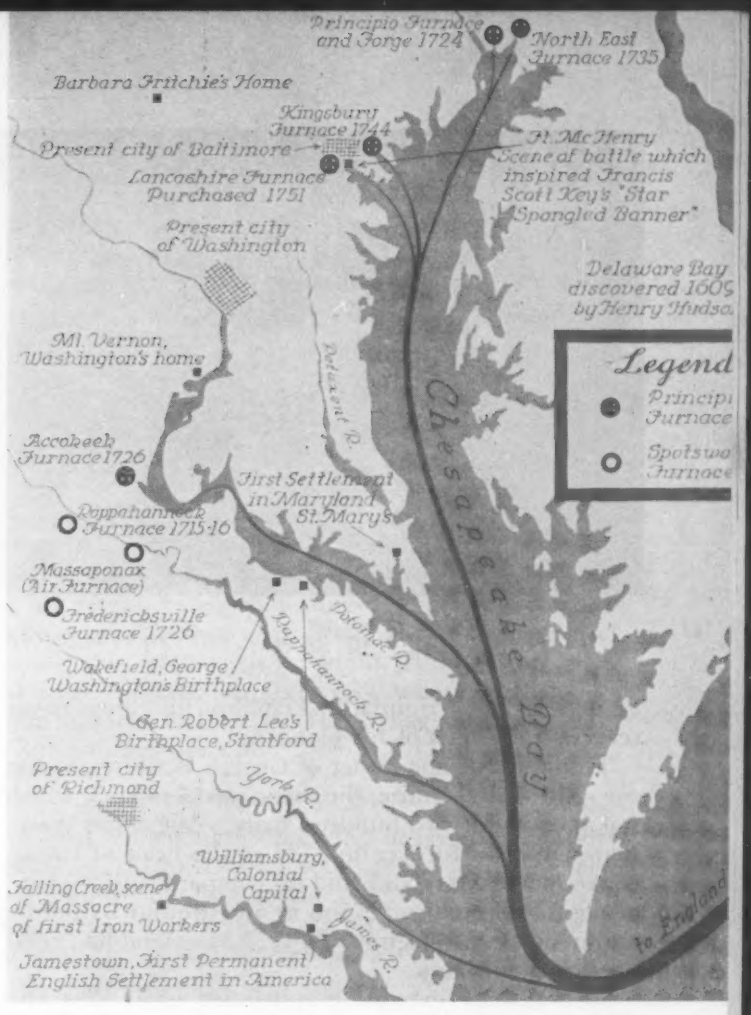
Some information on labor and working conditions at this earliest of American iron foundries may be of interest. Labor at the plant was made up mainly of Scottish prisoners of war captured at Dunbar by Cromwell in England. Two other types of laborers also were

Digging bog ore from swamps, a method commonly used by early iron furnaces in the American Colonies.

available: first, indentured men who had sold their services for seven years for passage to America, and, second, freed men. Occasionally labor was even recruited from the Indians during rush periods.

Pay averaged from ten cents per hour for unskilled labor to seventeen cents per hour for skilled labor. A work day was from sunrise to sunset, six days a week, and the crew at Saugus Iron Works probably averaged about fifty men.

Saugus Iron Works should be remembered on several historic scores, primarily because Jenks, the first molder, obtained the first patent granted to anyone in the colonies for the invention of the two-handed scythe, a tool still made in the same original shape. Jenks also was responsible for coining the first American money—the Pine Tree coinage of the Colony of Massachusetts. Also, due to the interest of John Winthrop, Jr., son of



Growth of iron furnaces in the Delaware, Maryland, Virginia area. George Washington's father was a founder of the Principio Furnace and Forge (top).

the governor of Massachusetts, the first fire fighting equipment for Boston was made in this plant in 1654.

Although it formed the start of an industry which eventually was to number over five thousand plants, the Saugus Iron Works itself never became great. The company failed in 1688 due to litigation, nuisance suits and reduction of timber resources; yet it furnished an important beginning for the new colonies. It should be a matter of pride to foundrymen of today that the first industrial plant in America was a foundry and occupied an important place in American history.

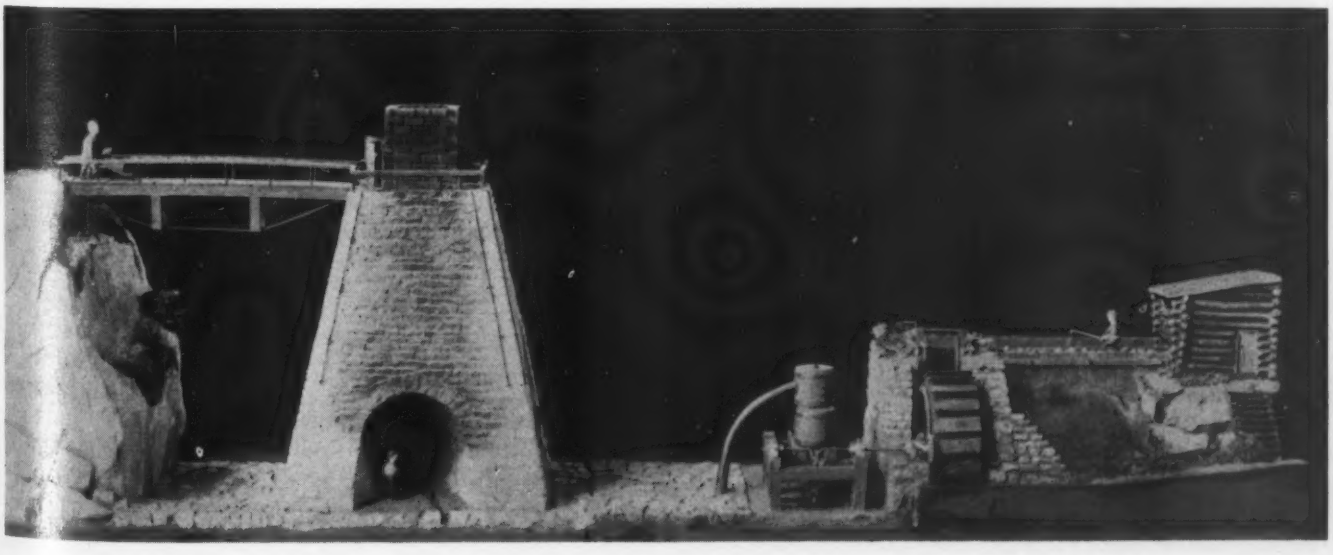
From this early beginning the direct-iron blast-furnace foundry spread quickly. A second works was started at Braintree near Boston in 1645, and we have this verbatim report on the plant as it existed in 1647: "We have cast some tuns of pots, likewise mortars, stoves, skillets, etc. Our potter is moulding more at Brayntree as yet, which place after another blowing we shall quit, not finding mine [ore] there."

Growth of Iron Founding

In quick succession, plants were established at Taunton in 1653 and at Concord and Rowley in 1657. By 1700 a dozen plants existed in eastern Massachusetts, including that of the Leonards at Raynham, and Massachusetts became the center of metalworking. Meanwhile, activity had spread to other states. John Winthrop, Jr., built Connecticut's first blast-furnace foundry at New Haven. In 1658 Joseph Jenks, Jr., son of the famous first molder at Saugus, erected a plant at Pawtucket, Rhode Island, which burned out in 1675. Henry Leonard, who was from a famous foundry family, moved into New Jersey and established the industry in that state. Col. Lewis Morris was also an early operator there and is said to have employed the first cast-iron-cylinder compressed air blast in America.

In the southern part of Maryland and Virginia no iron was produced for many years following the abortive attempt at Falling Creek. However, Virginia in 1715 was blessed with a progressive governor, Col Alexander Spotswood, who labored steadily to forward iron foundry progress (see map). He established a furnace on the Rappahannock River at the junction of the Rapidan. Pig iron was hauled fifteen miles to Massaponax where, by means of an air furnace, the metal was cast into firebacks, cooking utensils, andirons, etc.

The quality of the iron produced by this remelt process surprised the English and is truly remarkable when it is recalled that the remelt process had only just begun in France. Spotswood established another furnace at



A typical cold blast furnace making pig and cast iron in Colonial America. Note water-driven bellows and charging bridge. (Reproduced from a diorama now on display at the Chicago Museum of Natural History).

Ruins of the Amesbury furnace, built in 1754 by Allen and Turner and still standing near High Bridge, N.J.

Fredericksville, Virginia, in 1726, but his efforts never reached the limits of his planning.

To the north, the father of George Washington was engaged in establishing the Principio Company, which was to exist for two hundred years. Augustine Washington built a furnace in 1724 at the head of Chesapeake Bay in Maryland, and his company built a chain of plants in rapid succession in and around Baltimore and in northern Virginia. By 1750 Maryland had eight operating furnaces.

Such furnace expansion continued until 1754 and was successful for years as a commercial foundry and furnace enterprise. New Jersey and Pennsylvania had by then entered the race to produce iron and other castings so badly needed in this new and rough country, and were prominent iron producers by the middle eighteenth century.

One early New Jersey plant is particularly interesting in that it still exists as a foundry and traces its lineage back to 1742. The Taylor-Wharton Iron & Steel Company of High Bridge, New Jersey, is the oldest foundry and probably the oldest industrial corporation of continuous existence in the United States.

This plant had its beginning in December of 1742 when a foundry furnace was erected by William Allen and Joseph Turner under the name of the Union Furnace. Shortly afterward, in 1754, another furnace was built in the same area, called the Amesbury Furnace. In 1760 Robert Taylor became works manager of Union Furnace and subsequently took over the plant in 1780. During the Revolution this furnace supplied the Colonial troops with guns and shot. In 1860, still by direct descent, the name was changed to Taylor and Lange. In 1868 it became Taylor Iron Works, and finally adopted the present name of Taylor-Wharton Iron & Steel Company in relatively recent years.

Pennsylvania also was moving rapidly to exploit her mineral resources. Again iron took the lead, due to the needs of the expanding frontier and the fact that the inhabitants relied on iron in carving their homes out of the wilderness.

Several interesting iron works in eastern Pennsylvania deserve attention. In 1742 the Franklin stove was invented by Benjamin Franklin, who obtained his castings from a foundry known as the Warwick Furnace, near Warwick, Pennsylvania. This stove, a new

This early American iron fireback was cast by the Saugus Iron Works, Lynn, Mass., in the year 1660.

invention soon widely adopted, was made possible through castings and increased cast metals tonnage.

In 1742, for example, a furnace-foundry known as the Mount Joy Forge was erected in Chester County, Pennsylvania, on Earl Valley Creek; later the name was changed to Valley Forge. This famous foundry was burned by the British in 1777 and, as every American schoolboy knows, Valley Forge served as the encampment of the American Army during that terrible winter of 1777-78 when American Revolutionary fortunes were at their lowest ebb. Later this furnace was rebuilt, and important early experiments on steel castings were carried on there. American history, indeed, is closely and frequently associated with the foundry industry.

The Iron Plantations

No history of the American foundry industry would be complete without a description of the iron plantations, great estates which existed principally in eastern Pennsylvania in the eighteenth century. Dozens of these semi-industrial and partly feudal establishments, "growing" iron rather than cotton, had been established by 1750. One typical enterprise was the Hopewell Village near Birdsboro, Pennsylvania, now being

restored by the National Park Service and well worth a visit by any foundryman.

William Bird bought this tract of possibly 10,000 acres in 1743; in 1761 his son built the furnace and developed the plantation. At one time nearly 1,000 persons (including furnace men, molders, miners, charcoal burners, wagon-men and their families) lived there and derived their existence almost entirely from the production of pig iron and castings. The iron mine was located a mile or so from the furnace, and ore was carted in. The furnace used charcoal in stupendous quantities, averaging around 15,000 cords a year. Most inhabitants were wood cutters and charcoal burners, who prepared the charcoal in mounds in the forest.

Iron and castings were sent to Philadelphia by boat or cart, but the inhabitants lived, worked and died on the plantation. The workers were free, of course, but for the most part were content to live out their lives on the plantation. The patriotism of the younger Bird to the American Revolutionary cause cost him his plantation when, in 1777, he equipped and led an entire company of 300 men to fight for the colonies and in addition loaned the Revolutionary government large sums of money, the non-repayment of which finally ruined him.

Many colorful figures developed on the iron plantations. One was Baron Henry William von Stiegel, who in 1752 operated Elizabeth Furnace in Lancaster County, Pennsylvania. He produced a large quantity of castings, from kitchen utensils, firebacks and stoves to complicated pieces for export to sugar refineries in the West Indies, and in 1762 he built the town of Manheim, where he erected a glass factory.

Stiegel brought expert German glass designers from Germany at great expense. Here was developed the famous and now prized Stiegel glass, made possible by a successful foundry enterprise. However, over-expansion ruined Stiegel, like so many others, and, in greatly reduced circumstance, he was finally forced to work as a clerk in one of his own furnaces, then in the hands of his creditors.

Toward the end of the eighteenth century, the furnaces and foundries of America began to move westward. The first ferrous foundry established west of the Alleghenies was built in Fayette County, Pennsylvania, in 1792 by William Turnbull. This foundry supplied guns and shot for General Wayne's expedition against the Indians. In the same year, the first plant in Pittsburgh was erected by George Anschultz, who made stove and grate castings. A furnace also was established at the same time on Licking River in Bath County, Kentucky. So close to the frontier was this plant that a stockade was built around the furnace, and an armed guard was required against Indian attacks.

Far to the north in Canada, the first Canadian foundry had been installed years before, in 1730, at a location south of Three Rivers, Quebec. This foundry operated for 150 years. As an interesting sidelight, the molders had a quaint custom of dusting visitors' shoes free of foundry dust as they left the plant. If the resulting tip was large enough, no more work was done that day, while molders, melters and the management all drank to one another's health.

Foundries and the Revolution

A final commentary on eighteenth-century foundry operations in the United States concerns the connection between the foundry industry and the American Revolution. It is generally accepted by every schoolboy that the stamp tax on tea and "taxation without representation" were primary causes of the American Revolution; actually, however, history reveals even more fundamental reasons, involving the casting of metals. In 1750 the English parliament, jealous of the growth of ironworking in the Colonies, passed an act prohibiting the refining of pig iron or the casting of iron in the colonies. In addition, this act restricted the building of any additional furnaces or forges. Pig iron could be made only if it was shipped to England, where a charcoal shortage had curtailed iron production.

This act, of course, would have been a fatal blow to American frontier expansion, since it meant virtual

Artist's reconstruction of the great iron plantation, Hopewell Village, near Birdsboro, Pa., being restored by the Government as a national park. These baronial, iron producing estates existed during the 18th Century.

strangulation of a country badly in need of metal for its own use. As much as any other single grievance, and long before the issue of the tea tax arose, England's restrictions on the refining and casting of iron brought forth the kind of resistance that usually precedes every uprising. The act was openly flouted, and the agents of the British Crown soon lost their prestige.

For the most part, the Colonial founders joined the Revolutionary cause and supported it with money, guns and shot. Other foundrymen supported it politically, and six men prominent in Colonial iron founding signed the Declaration of Independence in 1776.

Philip Livingstone, Ancram Creek Furnace, N.Y.
George Taylor, Dunham Furnace, Pennsylvania.
James Smith, Codorus Forge, Pennsylvania.
George Ross, Mary Ann Furnace, Pennsylvania.
Stephen Hopkins, Hope Furnace, Rhode Island.
Charles Carroll, Carrollton, Maryland.

Among the many foundrymen who fought in the Continental Army as officers were Nathaniel Green, Rhode Island Furnace, who commanded at the battle of Long Island; Ethan Allen, Connecticut Furnace, who commanded the "Green Mountain Boys" at Fort Ticonderoga; and Lord Sterling, Sterling Iron Works, who served on General Washington's staff.

Arsenals of Freedom

Production of war materiel, of course, was the principal task of the American foundries during the War for Independence. Many foundries made shot, shell and cannon in great quantities, and it was because of the efforts of these founders that supplies kept coming to Washington's ragged and exhausted troops. Frequently, these same founders remained unpaid. As always in time of war, foundries were military objectives, and the British pointed their raids toward their destruction. At times undelivered cannon and shot were buried to keep them from falling into enemy hands in case the furnaces were captured.

During the Revolution another stalwart figure appeared whom the average person does not ordinarily associate with the casting of metals—Paul Revere. Made legendary by Longfellow's poem "The Midnight Ride of Paul Revere," that Revolutionary patriot who rode from Boston to Lexington on the night of April 18, 1775, to warn of the approach of the British, was a foundryman by trade.

Paul Revere, Foundryman

Prior to the Revolution, Revere had acquired experience in casting bronze and silver for bells and tableware, and many articles made from iron. However, his major metallurgical experience was obtained when he was assigned by the Continental government to work with Louis de Maresquelle (Lewis Ansort), a French founder of exceptional ability. Ansort was able to soften iron by mixing his metals, and he also introduced the completely bored, solid cast gun.

Under this master founder, Revere learned metallurgical techniques which later were to stand him in good stead in his further work on the malleability of copper. After the war, Revere returned to his bell-and-fittings foundry in Boston. His diary shows typical foundry troubles, since he was constantly in difficulty with his neighbors due to smoke from his stacks.

One of Revere's most famous bells was a recast of a bell which hung in the Old North Church in Boston and from which he had received his fateful signal "on the eighteenth of April in Seventy-five." This renowned bell also is noteworthy for a totally different reason—from the point of view of tone, it was a poor casting. In an effort to improve tonal quality, Revere began to experiment with various types of copper and copper alloys. His metallurgical success is well known today, and a great American company bearing his name—the Revere Copper & Brass Company—is the direct descendant of Revere's original enterprise.

No account of the relation between bells and the American colonies would be complete without mention of the famous Liberty Bell, whose ringing in Philadelphia on July 4, 1776, announced the signing of the American Declaration of Independence. The Liberty

Making charcoal in piles for use in iron plantation furnaces.

Five Colonial iron foundrymen who were signatories to the Declaration of Independence. Left to right: George Taylor, Durham Furnace, Pa.; Philip Livingstone, Ancram Creek Furnace, N.Y.; Stephen Hopkins, Hope Furnace, R.I.; George Ross, Mary Ann Furnace, Pa.; Charles Carroll of Carrollton, Md.; James Smith, Codorus Forge, Pa.

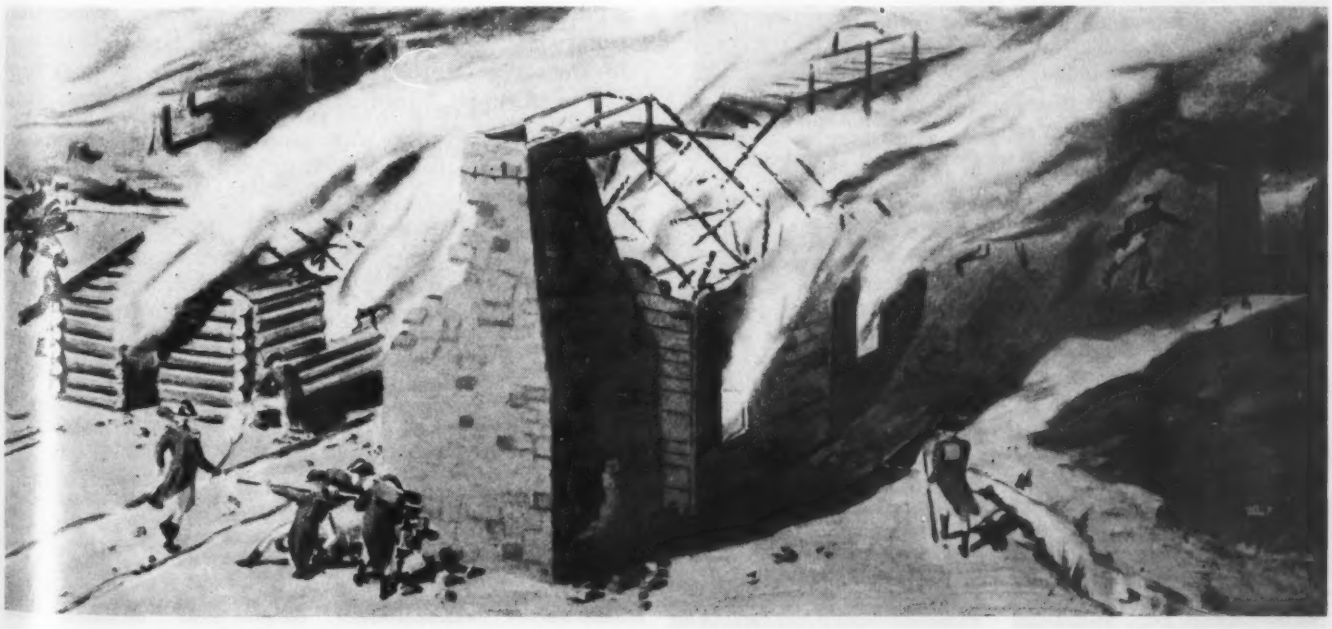
Bell was cast by Thomas Lister of Whitechapel, London, to mark the fiftieth anniversary of the Commonwealth of Pennsylvania. The bell cracked twice during testing and has been recast twice, its original tone being considerably altered by the amount of copper added in the recasting. This most revered of all American bells weighs 2080 pounds and now is preserved in Independence Hall, Philadelphia, where it was originally hung.

The War of 1812 also contributed to foundry history in a rather interesting way. During that conflict Henry Foxall, a combination preacher and foundryman, was making castings for the United States at Georgetown, Maryland. The British, after burning the White House in Washington, marched toward Georgetown to destroy the foundry, and Foxall vowed that if his foundry were spared he would establish a new Methodist church in the nation's capital.

Due to a sudden terrific electrical storm, the British were delayed and then prevented from reaching the foundry. As good as his word, in 1815 Foxall built in Washington, D. C., the Foundry Methodist Church, today one of the largest and most beautiful churches in the capital. Many presidents and distinguished visitors have worshipped here, and the story of this house of worship calls to mind the fact that John Wesley began Methodism in London, England, many years before, in what previously had been a foundry.

The account of the development of cast metals in colonial United States ends with the infant but vigorous foundry industry spreading the length and breadth of the new land. American genius for mechanical achievement was prepared to advance the general world-wide progress of the industry. The nineteenth century, in turn, brought forth progressive mechanical and metallurgical advancements that were to accelerate greatly the slow and laborious gains already made in the art of casting metals and metal products to serve mankind.

The British burned the foundry at Valley Forge, Pa., in 1777 to prevent the manufacture of arms for the Continental Army. Later used as Washington's winter quarters, Valley Forge was rebuilt as a furnace.



Max Kuniansky

A. F. S. NOMINATING COMMITTEE SELECTED

SELECTION OF A NOMINATING COMMITTEE to name officers and directors of A.F.S. for 1949-50 has been made by the Executive Committee. Chosen are:

Past President Max Kuniansky, vice-president and general manager, Lynchburg Foundry Co., Lynchburg, Va.—*Chairman.*

Past President S. V. Wood, president and manager, Minneapolis Electric Steel Castings Co., Minneapolis.

Alexander C. Andrew, foreman, American Locomotive Co., Schenectady, N.Y.—representing the Eastern New York Chapter and gray iron.

C. E. Shaw, works engineer, American Steel Foundries, Alliance, Ohio—representing the Canton District Chapter and steel.

Howard B. Voorhees, foundry superintendent, Peru Foundry Co., Peru, Ind.—representing the Michiana Chapter and gray iron.

George W. Zabel, general superintendent of foundries, Fairbanks-Morse Co., Beloit, Wis.—representing the Northern Illinois-Southern Wisconsin Chapter, gray iron, and brass and bronze.

Paul L. Arnold, resident manager, U. S. Pipe & Foundry Co., Chattanooga, Tenn.—representing the Tennessee Chapter and gray iron.

J. O. Klein, vice-president, Texas Foundries, Inc., Lufkin, Texas—representing the Texas Chapter, malleable iron and aluminum.

Anton Johnson, works manager, Oklahoma Steel Castings Co., Tulsa, Okla.—representing the Tri-State Chapter and steel.

The Nominating Committee was chosen in accordance with Article 10, Section 2, of the By-Laws which states: *On or before October 1 of each year the Executive Committee of the Board of Directors shall appoint a Nominating Committee of seven members, six of whom shall be from the list of eligible candidates submitted by the various chapters, and one of whom may be from the list of members residing outside chapter territories, who, together with the last two living presidents, shall constitute a Nominating Committee of nine members.*

In appointing the Nominating Committee the Executive Committee shall elect members thereof in such a manner as to provide equitable, regional representation, and shall consider proportional representation for the several branches or divisions of the membership.

The 1949-50 Nominating Committee was selected

S. V. Wood

A. C. Andrew

C. E. Shaw

H. B. Voorhees

G. W. Zabel

P. L. Arnold

J. O. Klein

from candidates proposed by chapters not represented on the Committee during the past two years. The names of two candidates were submitted by such chapters to the president of A.F.S. prior to July 1.

The Nominating Committee is required by the By-Laws to meet at least 90 days prior to the Annual Business Meeting and the names of the nominees selected by the Committee must be published in AMERICAN FOUNDRYMAN at least 60 days before the Annual Business Meeting. A meeting of the Nominating Committee problaby will be held before the end of the year.

Members of the A.F.S. Executive Committee who selected the 1949-50 Nominating Committee are: A.F.S. President W. B. Wallis, Vice-President E. W. Horlebein, Past President Max Kuniansky, and National Directors S. C. Wasson, J. M. Robb, Jr., and V. E. Zang.

Anton Johnson

ESTABLISH A. F. S. STAFF RETIREMENT PLAN

IN ACCORD WITH INDUSTRIAL PRACTICE the A.F.S. Board of Directors has established a retirement fund for salaried employees of the Society known as the "American Foundrymen's Society Staff Retirement Plan." Approved at the July 30 Board meeting, the Plan enables staff members to build up a retirement income which becomes payable, under normal conditions, at age 65. Like most similar plans established in the foundry industry and other industries, funds for operation are provided jointly by employees and by the Society.

Administration of the Plan is in the hands of four Trustees appointed by the Board. The first Trustees named are National Director Bruce L. Simpson, president, National Engineering Co., Chicago; Frank W. Shipley, foundry manager, Caterpillar Tractor Co.; Peoria, Ill.; Ralph L. Lee, secretary-treasurer, Grede Foundries, Inc., Milwaukee; and H. Bornstein, director of laboratories, Deere & Co., Moline, Ill.

Under the Plan, employees are eligible to participate after they have completed three years of continuous service with the Society and have reached the age of 30. Their savings, deducted at regular pay periods, together with the Society's contributions, are paid over to the Trustees for investment in retirement annuity policies issued by an established legal reserve life insurance company.

In the event of a participant's death or termination of service prior to retirement, a refund will be made of all his contributions to the Plan, with two per cent interest, compounded annually, added. If he remains in service until retirement, he will receive a minimum annual income of $300.

Retirement income is guaranteed for 10 years. If a participant dies after annuity payments commence but before they have been paid for a full 10 years, his beneficiary receives the income for the balance of the 10 years.

Borrowing against the values of the policies held by the Trustees on behalf of A.F.S. employees is not permitted. This would tend to defeat the purpose of the Plan. Payments made by the Society and by the individuals are not taxable at the time the payments are made. However, the benefits of the Plan are subject to tax at the time they are received.

The Trustees who control the Plan are appointed by the Board of Directors to serve until they are replaced. Illinois laws, under which the Plan has been established, are to govern all questions which may arise with respect to the trust.

Appoint Foundry Industry Leaders To Government Advisory Committee

FOUNDRY INDUSTRY ADVISORY COMMITTEE members have been appointed by the Munitions Board. These men, listed below, will advise the Board and the Iron and Steel Industry Advisory Committee on wartime castings procurement problems.

Members of the Foundry Industry Advisory Committee are: General Donald Armstrong, USA (ret), vice-president, U. S. Pipe & Foundry Co., Burlington, N.J.; George W. Cannon, chairman of the board, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.; C. L. Carter, president, Albion Malleable Iron Co., Albion, Mich.; F. Kermit Donaldson, vice-president & general manager, Machined Steel Castings Co., Alliance, Ohio; O. L. Earl, vice-president, Acme Aluminum Foundry Co., Inc., Chicago; F. Ray Fleig, president, Smith Facing & Supply Co., Cleveland; John E. Galvin, chairman of the board, Ohio Steel Foundry Co., Lima, Ohio; A.F.S. Vice-President E. W. Horlebein, president, Gibson & Kirk Co., Baltimore, Md.; Thomas Kaveny, Jr., president, Herman Pneumatic Machine Co., Pittsburgh; A.F.S. Past President Max Kuniansky, vice-president and general manager, Lynchburg Foundry Co., Lynchburg, Va.

Represent Whole Foundry Industry

A. J. McDonald, vice-president, American Steel Foundries, Chicago; W. H. Moriarty, vice-president, National Malleable & Steel Castings Co., Cleveland; Thomas W. Pettus, president, National Bearing Metals Corp., St. Louis; F. E. Shumann, president, Lehigh Foundries, Inc., Easton, Pa.; W. L. Seelbach, president and general manager, Superior Foundry Co., Cleveland; David B. Shannon, general manager, Chattanooga Plant, Somerville Iron Works, Chattanooga, Tenn.; J. H. Smith, general manager, Central Foundry Division, General Motors Corp., Saginaw, Mich.; Frank

G. Steinebach, vice-president and secretary, Penton Publishing Co., Cleveland; Fred S. Wellman, president, Wellman Bronze & Aluminum Co., Cleveland; and J. Donald Zaiser, Ampco Metal, Inc., Milwaukee.

Formation of the Foundry Industry Advisory Committee was instigated by the National Castings Council with the expectation of averting the castings supply problem which occurred during the recent war. The Council is comprised of representatives from American Foundrymen's Society, Foundry Equipment Manufacturers Association, Foundry Supply Manufacturers Association, Gray Iron Founders' Society, Malleable Founders' Society, National Founders Association, Non-Ferrous Founders' Society, and Steel Founders' Society of America.

Gray Iron Founders Society To Hold Annual Convention In Atlantic City

PRINCIPAL SPEAKERS at the 20th Annual Meeting and Convention of the Gray Iron Founders' Society, to be held at Haddon Hall, Atlantic City, October 14-15, will be William B. Given, president, American Brake Shoe Co., and Col. Harold Hoffman, former governor of New Jersey. Both will address the annual Noon Day Luncheon meeting.

Participating in a symposium on foundry hygiene on October 14 will be E. A. Hamlin, medical director, American Brake Shoe Co.; Theodore F. Hatch, research director, Industrial Hygiene Foundation of America, Inc.; and Theodore C. Waters, partner, Mulliken, Stockbridge and Waters, Baltimore.

Other prominent speakers on the program are: Dr. Robert S. Hartman, executive secretary, Council of Profit Sharing Industries, Wooster, Ohio; H. C. Nickolas, president, Quality Castings Co., Orville, Ohio; John A. Claussen, secretary, Merchant Pig Iron Committee, American Iron & Steel Institute, New York, N.Y.; and James H. Smith, general manager of the Central Foundry Division, General Motors Corp., Saginaw, Mich.

Howard A .Stockwell, Barbour Stockwell Co., Cambridge, Mass., president of the Society, will preside at all sessions of the 20th Annual Meeting.

Publish Registered Attendance List For 1948 Foundry Congress And Show

THE REGISTERED ATTENDANCE LIST for the 1948 A.F.S. Convention, held in Philadelphia, May 3-7, is available. Distributed gratis as a service to exhibitors at the Convention, the list now may be obtained by anyone interested in the names of top foundry management and operating personnel. In addition many other foundry executives listed directly influence foundry purchases.

Arranged geographically to facilitate ready reference, the list gives the company name and address, and title, of all registrants. Included are foundry representatives from 40 states, the District of Columbia, six Canadian provinces, Mexico, and 15 countries outside of North America.

To those who did not exhibit at the 1948 Foundry Congress and Show, the REGISTERED ATTENDANCE LIST costs $10.00. For a copy, write to American Foundrymen's Society, 222 W. Adams St., Chicago 6, Ill.

Incorporate American Standards Association Under New York Laws

THE AMERICAN STANDARDS ASSOCIATION, underwent the third organizational change in its 30-year history on August 2, when it became the American Standards Association, Inc., through incorporation under the laws of the State of New York.

Organized in 1918 as the American Engineering Standards Committee, a coordinating committee for the standardization work of five of the country's important technical societies, the scope was broadened to include associations and government agencies. This lead to the extension of work into the field of safety standards. In 1928, an entire reorganization took place, changing the American Engineering Standards Committee to the American Standards Association.

The present change to an incorporated Association again recognizes the enlarged activities and responsibilities of the organization and gives it the benefits of corporation law. Bills seeking Federal incorporation were recently introduced in both the Senate and House of Representatives and are pending Congressional action at present.

The Association's coordinating functions now extend to standards in the mechanical, electrical, building, photographic, mining, safety, and consumer goods fields, as well as such general work as that on office equipment and abbreviations and symbols for use in engineering and scientific literature.

Trite But True

THE STATEMENT "you only get out what you put in" applies particularly to A.F.S. membership. One way to get more out of your membership in the Society is to participate in the work of the national committees as well as in the chapter committees.

Numbering over 100, the committees of A.F.S. provide the technical leadership for the Society and for the foundry industry. If you are interested in serving on one or more of the general interest or specific interest committees you are urged to consider carefully those to which you can contribute the most.

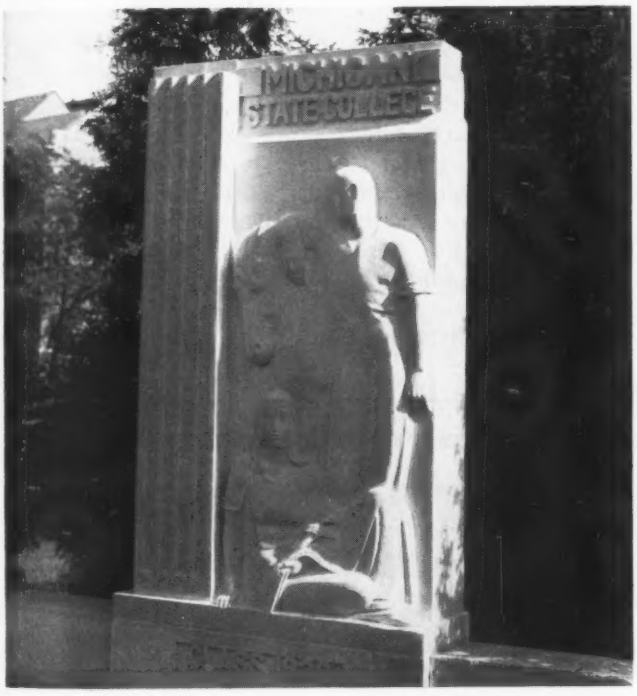
Your field of interest or of greatest experience may be in any of the eight technical divisions: Aluminum and Magnesium, Brass and Bronze, Education, Gray Iron, Malleable, Pattern, Sand, or Steel. In addition to these specific interest groups—each comprising a number of committees—there are the general interest committees: Chemical Analysis, Fluidity Testing, Foundry Cost, Heat Transfer, Job Evaluation and Time Study, Plant and Plant Equipment, Precision Investment Casting, and Refractories.

Indicate your interest in A.F.S. national committees by writing of your experience to The Technical Director, American Foundrymen's Society, 222 W. Adams St., Chicago 6, Ill. He will relay this to the appropriate committee chairman whose prerogative it is to appoint members of his committee.

ANNOUNCE MICHIGAN FOUNDRY CONFERENCE

THE PROGRAM for the Michigan Regional Foundry Conference to be held October 1 and 2 at Michigan State College, East Lansing, includes technical talks on basic foundry materials, foundry layout, metallurgy, foundry personnel, and a scrap clinic. An annual two-day meeting sponsored by the Michigan State College Institute of Short Courses and the four A.F.S. chapters in Michigan, the Conference is expected to attract well over 200 foundrymen. All technical sessions will be at R. E. Olds Hall of Engineering.

The final session of the Conference will feature a scrap clinic with Harry E. Gravlin of Ford Motor Co., Dearborn, Mich., in charge. He will exhibit a number



of defective commercial castings and lead a group discussion on causes and remedies.

The program announced by the Conference Committee is:

Friday, October 1

8:30 a.m.—Registration in Room 111, R. E. Olds Hall of Engineering.

8:30-9:45 a.m.—Engineering Shops open for inspection.

9:45 a.m.—Welcoming Address, Karl H. McDonel, secretary, Michigan State Board of Agriculture.

10:00 a.m.—Greetings from National A.F.S. Officers.

FIRST TECHNICAL SESSION. Chairman: Stanley H. Davis, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

10:30 a.m.—*"Mold and Core Wash Materials,"* Dr. J. A. Ridderhof, Frederic B. Stevens, Inc., Detroit, and Robert Melmoth, Ford Motor Co., Dearborn, Mich.

12:15 p.m.—Luncheon.

SECOND TECHNICAL SESSION. Chairman: Oscar E. Sundstedt, General Foundry & Mfg. Co., Flint, Mich.

2:00 p.m.—*"The Physical, Mechanical, and Chemical Properties of Foundry Core Binders,"* J. A. Gitzen, Delta Oil Products Co., Milwaukee.

3:00 p.m.—*"Gray Iron Metallurgy and Foundry Practice,"* K. H. Priestley, Vassar Electroloy Products Inc., Vassar, Mich.

4:00 p.m.—*"Foundry Layouts,"* R. L. McIllvaine, National Engineering Co., Chicago.

6:00 p.m.—Dinner and Entertainment, Hunt Food Shop, East Lansing. Chairman: L. G. Miller, dean of engineering, Michigan State College. *"My Year in Japan,"* Russell E. Horwood, associate professor, Dairy Department, Michigan State College.

Saturday, October 2

THIRD TECHNICAL SESSION. Chairman: A. W. Stolzenburg, Aluminum Co. of America, Detroit.

9:00—*"Attracting and Keeping Good Men in Your Foundry,"* George Tubich, Michigan Department of Health.

10:00—*"Sand, Metal, or Men?"* Harry E. Gravlin, Ford Motor Co., Dearborn.

2:00—Football Game.
Michigan State College vs. University of Hawaii.

This year's Michigan Regional Foundry Conference has been planned by: Jess Toth, Harry W. Dietert Co., Detroit, and Harry E. Gravlin, Ford Motor Co., Dearborn, representing the Detroit Chapter; W. A. Hallberg, Lakey Foundry and Machine Co.; Muskegon, and George Tubich, Michigan Department of Health, representing the Western Michigan Chapter; Fitz Coghlin, Jr., Albion Malleable Iron Co., Albion, Mich., representing the Central Michigan Chapter; Robert L. Calkins, The Clio Foundry Co., Clio, Mich., and L. L. Clark, Buick Motor Co., Flint, Mich., representing the Saginaw Valley Chapter; Professors H. L. Womochel, C. C. Sigerfoos, and R. J. Kleis, and L. M. Fagerlund, representing Michigan State College.

Plan 1949 Ohio Foundry Conference

PLANNING THE SECOND OHIO REGIONAL FOUNDRY CONFERENCE around the theme "New Developments for the Operating Foundryman," representatives of the five Ohio chapters of A.F.S., of Ohio State University, and of the OSU Student Chapter, met July 22 on the campus for their first meeting. The group set the time and place of the Conference as March 11 and 12, 1949, in Columbus, Ohio.

The group was welcomed to the campus by Dr. Harvey H. Davis, vice-president of OSU, and Dean C. E. MacQuigg of the College of Engineering, who promised the full cooperation of the University in making the Conference a success.

Dr. D. C. Williams, department of industrial engineering, Ohio State University, was named general conference chairman. Chairman and vice-chairman, respectively, of the Program Committee are: Dan E. Krause, Gray Iron Research Institute, Columbus, and N. J. Dunbeck, Eastern Clay Products, Inc., Jackson.

The following were at the meeting: F. W. Fuller, National Engineering Co., Walter L. Deutsch, Columbus Malleable Iron Co., Dan E. Krause, and C. T. Greenidge, Battelle Memorial Institute, all of Columbus, William T. Bland and Robert A. Willey, both of Commercial Steel Castings Co., Marion, and N. J. Dunbeck, representing the Central Ohio Chapter; A. D. Barczak, Bardes Forge & Foundry Co., and A. J. Smith, Lunkenheimer Co., representing the Cincinnati Chapter; E. H. Taylor, F. E. Myers & Bros. Co., Ashland, representing the Canton District Chapter; H. G. Schwab, Bunting Brass & Bronze Co., representing the Toledo Chapter; William G. Gude, Penton Publishing Co., Cleveland, representing the Northeastern Ohio Chapter; T. S. Dale and H. J. Gonya, representing the OSU Student Chapter; and Dr. D. C. Williams, representing the University.

APPROVE SIXTH STUDENT GROUP

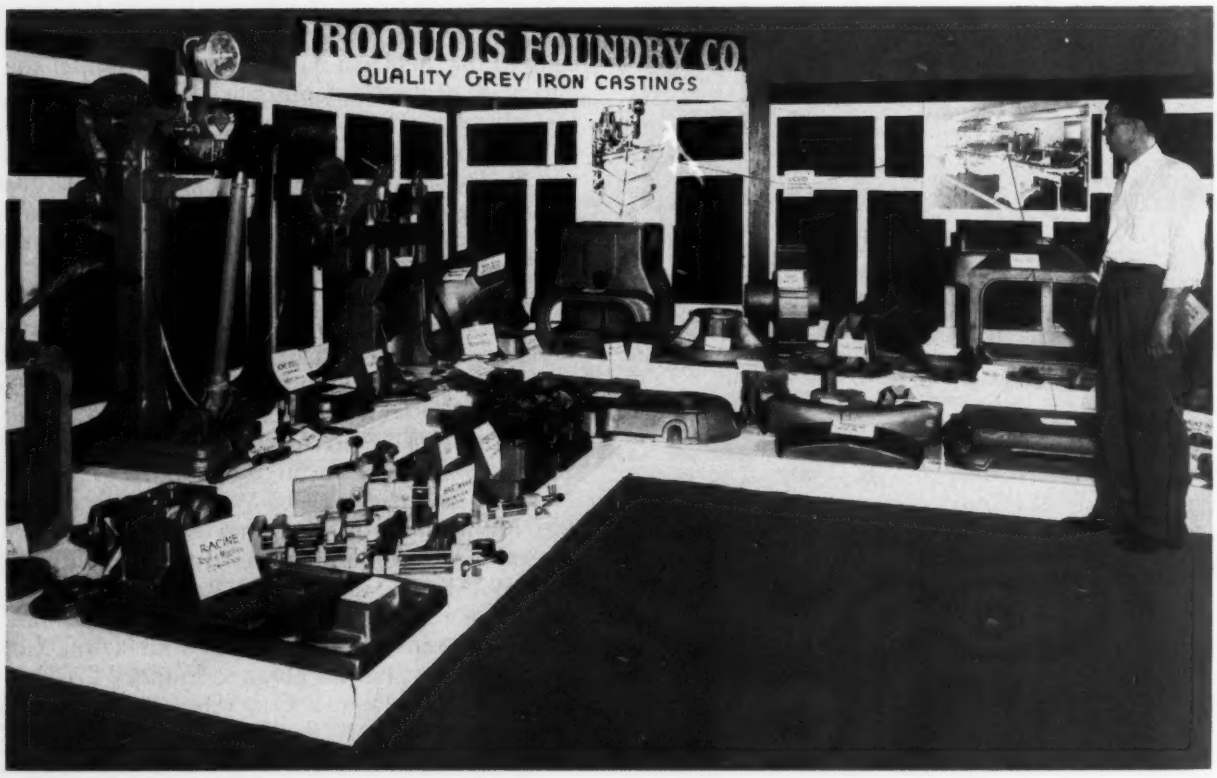
START CHAPTER AT UNIVERSITY OF ILLINOIS

THE SIXTH STUDENT CHAPTER—organized at the University of Illinois (Urbana)—has been approved by the A.F.S. Board of Directors. Expected to be installed shortly after the opening of the fall semester, the chapter has elected officers, and has a faculty and an industrial advisor. Faculty advisor is James L. Leach, assistant professor of mechanical engineering. Clinton B. Soper, vice-president of American Foundry & Furnace Co., Bloomington, Ill., a director of the Central Illinois Chapter, is industrial advisor.

Officers of the newly approved student chapter are: Charles E. Drury, chairman; Harold French, vice-chairman; Robert W. Bales, secretary; and Joseph M. David, treasurer. Other student members of A.F.S. who petitioned for recognition as the University of Illinois (Urbana) Student Chapter are: John J. Campbell, Roy K. Cannon, Gerald T. Crovey, Robert Eagleton, Morris G. Hocutt, Robert W. Klann, Philip Quebman, Charles Edwin Wadsack, Charles K. Waters, Edward Yencho, and William F. Zumwalt.

Student chapters previously formed are at the University of Minnesota, the Missouri School of Mines and Metallurgy, Ohio State University, Massachusetts Institute of Technology, and Oregon State College, which is expected to become an official member of the A.F.S. family of chapters this fall.

Foundry Exhibit Draws Crowds At Wisconsin Exposition



This exhibit of the Iroquois Foundry Co., Racine, Wis., at the "Made in Racine Centennial Exposition" was viewed by more than 45,000 people during the first week in July. The exhibit featured a representative line of castings made by the Iroquois Foundry, and, in each instance, the finished product for which the casting was made. Customers contributed products for the exhibit.

The second paper on use of anthracite in the cupola published in *American Foundryman*, "Anthracite-Coke Mixtures Used in High Speed Cupola Melting" by C. C. Wright and W. J. Reagan describes the successful use of coal in production melting operations carried on over a great part of 1947. The practice developed is currently in use. A previous paper by Professor Wright, entitled "Anthracite as Cupola Fuel," appeared in the November and December 1947 issues of *American Foundryman*. Both papers give complete operating data, tables, graphs, and illustrations, as well as many suggestions for improving on the techniques described. The papers provide practical operating information useful to foundrymen confronted with melting problems complicated by shortages of coke and melting stock.

ANTHRACITE-COKE MIXTURES USED IN HIGH SPEED CUPOLA MELTING

C. C. Wright
and
W. J. Reagan

THE EARLY HISTORY of the use of anthracite as cupola fuel, some of the factors influencing its selection and performance, and operating data on its use in the 36-in. intermittently tapped, non-slagged cupola at the Hudson Coal Co. have been adequately presented [1, 2, 3] at various anthracite conferences. Since the last conference, the scarcity of quality coke has led to more extended trials of anthracite by other foundries and to an extended program of research on the use of anthracite in high-speed melting operations. The present report deals principally with the results of this latter series of investigations, together with supplementary information on the use of anthracite in larger cupolas.

High-Speed Melting Operations

One of the factors that has often been questioned in connection with the use of anthracite as cupola fuel is the ability of this fuel to permit the high-speed melting commonly practiced in many foundries. Similarly, questions have been raised as to the feasibility of using anthracite in heats of more than a few hours' duration.

Unfortunately, the previously reported tests were of such a character that neither of these questions could be satisfactorily answered. For this reason, arrangements were made early in 1947 to conduct tests on the performance of anthracite in such operations at the Elmira Works, Apparatus Div., of the General Electric Co., Elmira, N.Y. Through the cooperation of the management and personnel of that organization, considerable progress has been made.

The cupola in which tests were made has a 51-in. shell diameter with the shaft lined to 33 in. The stack height from base plate to charging door is 17 ft. During part of the tests the melting zone, to a height of approximately 30 in. above the upper row of tuyeres, was lined to an inside diameter of 24 in. and for the remainder of the tests to 30 in. The unit is of the balanced blast type with three rows of four tuyeres each. The main tuyeres are 4 in. in diameter while the tuyeres of the two upper rows are 2 in. in diameter. The blower is of the centrifugal type, with watt-meter type air-weight control, capable of delivering a maximum of 125 pounds of air at 20 oz maximum pressure.

Operated with continuous metal and slag tapping, this cupola furnishes metal to permanent mold tables. Each table carries 12 permanent molds, each of which is capable of producing from 1 to 18 castings. The tables normally are operated at such a speed as to make about 100 revolutions per 8-hr day. During the period of operation with the 24-in. lining, only two tables were in operation, and the daily output of finished castings varied from about 4,000 to 7,000 pieces, depending on the particular type of castings in demand. The individual castings ranged in weight from 0.3 to 30 lb, and varied in types from relatively simple to complicated castings with adjacent heavy and thin sections. The 30-in. cupola furnished metal for three-table operations from which were obtained from 6,000 to 9,000 castings of similar character per day.

In terms of tonnage of metal melted, the following is indicative of what is obtained in this high-speed melting operation:

Cupola diameter at melting zone	24-in.	30-in.
Net tons per hr	2.2 to 2.5	3.7 to 4.0
Net tons per 7½- to 8-hr day	16½ to 18½	23 to 32

Fig. 1 shows the cupola, mixing ladle, and a portion of one of the permanent mold tables. Figure 2 shows one of the tables and the pouring of metal into one of the molds.

A description of the fuels used in this investigation is shown in Table 1. Detailed analyses are not included because, during the period of tests, several different cars of some of the fuels were used, sometimes at intervals of several months, and variations existed

NOTE: This paper, reporting the results of investigations into the use of anthracite as fuel in high-speed melting operations and in the larger cupolas, was presented at the Sixth Annual Anthracite Conference at Lehigh University, Bethlehem, Pa., May 6-7.

Fig. 1—View of cupola and mixing ladle. At left operator is pouring metal into permanent mold.

from car to car. With the exception of the volatile matter content of the anthracite and the ash and sulphur contents of all the fuel, fuel analysis appears to have little direct bearing upon the results reported.

The experimental investigation consisted of two parts: Studies on methods for accurately determining the temperature of the molten iron and the fluidity of the metal, and melting operations using various sizes and types of anthracite and coke. The two phases of the work were run concurrently.

After some experimentation with various types of protecting tubes, a standard for temperature measurement was developed which consisted of the use of a platinum-platinum rhodium thermocouple encased in double fused silica protection tubes. The inner tube was $\frac{3}{16}$-in. O.D. and the outer tube $\frac{3}{8}$-in. O.D. These tubes were mounted in a graphite head, and the insulated thermocouple leads carried out, through ½-in. iron pipe connected to the head, to a temperature compensated potentiometer. The thermocouple, inside its protecting tubes, was immersed in a well built into the cupola spout on the ladle side of the slag skimmer.

Temperature and Fluidity

Response to temperature after immersion of the thermocouple was quite rapid, and equilibrium was attained in about 30 sec. Usually, six to eight immersions were obtained before the outer protection tube needed replacement, and at one time the thermocouple was allowed to remain in the metal continuously for 2 hr. Erosion of the silica tube was too great, however, to permit the use of this arrangement as a continuously recording device. As a standard, however, the results obtained were eminently satisfactory.

In order to determine fluidity and to see what correlation could be obtained between fluidity, metal temperature and type of fuel used, a test was devised which simulated the casting of molten metal in the permanent mold units. A test mold* was designed and constructed as shown in Figs. 3 and 4. This test mold consists of a series of runs, 15 in. long, connected in series with a feeder gate and a riser.

Figure 5 shows the operator pouring metal into the top of this fluidity mold. The mold was maintained at relatively uniform temperature, after preheating with hot metal, by pouring tests at fixed (15 min) intervals. The mold was brushed and smoked after each test. It was found that the approximate range of fluidity, as a function of temperature, for a large number of tests was as shown in Table 2.

TABLE 2—RELATIONSHIP BETWEEN FLUIDITY TEST AND METAL TEMPERATURE

Length of Run, in.	Metal Temperature, F (Thermocouple)
17½	2500
19½	2525
21	2550
22½	2575
24	2600
26	2625
27½	2650
29	2675
31	2700

Over the range of fuels and conditions studied, fluidity did not vary greatly except as a function of temperature. A close correlation was observed, however, between the fluidity data and the pouring results on the tables. A fluidity of less than 17 in. almost invariably coincided with inability to pour castings with thin sections. Fluidities of 20 to 25 in. appeared to be most satisfactory for general operation. Extremely high fluidities, associated in these tests with extremely high temperatures, frequently caused the metal to leak out of the mold.

Two distinct series of melting tests were completed, one in the 24-in. cupola and the other in the 30-in. cupola. The two are herein discussed separately.

* This test mold was designed by Adam Mahonske, metallurgist, Elmira Foundry, and constructed in the foundry's shops.

TABLE 1—DESCRIPTION OF FUELS TESTED

Code No.	Fuel	Source	Nominal Size		Analysis[1]		
			Designation	Round Hole Screen, 2 in.	Volatile Matter	Ash	S
A	Anthracite	N. Field	Egg	2 7/16x3¼	—	—	—
A–2	Anthracite	N. Field	Grate	3¼x5	7.5	10.3	0.8
B	Anthracite	N. Field	Steamboat (Special)	5x8	5.7	7.0	0.9
C	Anthracite	S. Field	Grate (Special)	3x6	5.7	9.9	0.7
D	Anthracite	E. Middle Field	Broken	3¼x4½	4.9	12.3	0.5
1	Byproduct Coke	—	No. 4 Foundry	Approx. 3x4	—	8–10	0.7
1A	Byproduct Coke	—	No. 4 Foundry	Approx. 4x7	1.7	9.1	0.6
2	Byproduct Coke	—	No. 4 Foundry	Approx. 3x4	—	7–9	0.8

[1] Dry basis.
[2] Size designation; not actual screen analysis as charged. Coke sizes of 2¾x3¼ in. and plus 3 in. converted to approximate round hole equivalent.

TABLE 3—TYPICAL CUPOLA OPERATIONS IN 24-INCH CUPOLA

Metal to Fuel Ratio 6½:1 for all Tests.[1] Melting Rate 2.2 to 2.3 tons per hour.

Date	Fuel	Blast Air, lb/min	Windbox Pressure: Average, oz	Windbox Pressure: Time at Maximum Blower Pressure,[2] min	Temperature Range, F (Thermocouple)
7/10	All Coke No. 1	85	15½	1	2520–2635
7/8	50% Anthracite C	80	15	0	2660–2690
7/9	50% Anthracite C[3]	85+	19¾	145	2625–2690
7/11	75% Anthracite C	80+	17¾	15	2565–2610
7/16	50% Anthracite B	85+	18½	0	2550–2660
7/17	50% Anthracite B	85+	18¾	60	2520–2660
7/18	75% Anthracite B	90	20¼	250	2500–2660
8/11	50% Anthracite D	85−	15¼	0	2640–2720
8/12	75% Anthracite D	85	15½	0	2550–2665

[1] Standard Charge—Metal, 260 lb; Fuel, 40 lb; Limestone, 17 lb.
[2] Includes only time after initial blasting at start of operations.
[3] Very small coke and very dirty scrap.

Two-Table Operation—24-In. Cupola: In this series of tests, three different coals were studied in conjunction with Coke No. 1. Because of handling methods and problems, it was not possible to grade the coke for any of these tests, nor was it feasible to secure representative samples for screen analysis. At times the coke sized as small as 50 per cent through a 2-in. screen; at other times good size coke, averaging in the range of 3 by 5 in. and containing very little material below one in., was used. This size variation in the coke undoubtedly had some influence upon the results.

Data for a number of typical operations with coke and with coke-anthracite mixtures are shown in Table 3 at the standard 6½:1 metal to fuel ratio. Average pressure readings in excess of about 18 oz indicate borderline operations insofar as pressure is concerned. The time during which pressure is at a maximum is a further indication of borderline operation, since under such conditions the blower is operating at maximum delivery and no leeway exists.

Results obtained for the use of anthracite in the 24-in. cupola may be summarized as follows:

Melting Rate: The normal capacity of a 24-in. cupola, when using a 6½:1 ratio is supposed to be in the general vicinity of 1.6 to 1.8 tons per hour. The actual melting rates secured with both coke and coke-anthracite mixtures were in the range of 2.2 to 2.5 tons per hour. Because of this high melting rate, the blast velocity was greater than normal and pressure was somewhat higher than would be encountered at more normal melting rates.

Windbox Pressure: The blower on this cupola is designed to deliver the required quantity of air to the cupola at pressure below approximately 20 oz. When the resistance of the system exceeds this pressure, the volume of air delivered falls off rapidly. When using foundry size coke, pressures of the order of 13 to 16 oz are normally encountered and no difficulty is experienced, even at the high melting rates employed, from lack of blower capacity.

With anthracite-coke mixtures, pressures were generally somewhat higher than with coke alone, but became excessive only at the high percentages of anthracite (more than 50 per cent of Coal B, and more than 75 per cent of Coals C or D). In part, the excessive pressures at the higher anthracite percentages are believed to be due to the use of too low a ratio (as discussed in the following section), in part to the inherently denser bed produced with anthracite, and in part to decrepitation of the anthracite which caused a more compact charge and higher resistance.

Probably, the major cause of excessive pressures is the high melting rate per unit of cupola cross section. A slight increase in cupola diameter (2-4 in.) would permit the same volume of air to pass through the cupola with lower windbox pressure and lower melting rates per unit of cross section, but with same tonnage.

Bed Height and Fuel Ratio: Detailed observation on the operation of the cupola during the series of tests reported in Table 3 suggested that, at the higher percentages of anthracite, either the bed height or the fuel ratio was not correct for the particular conditions of operation. A test using 100 per cent of Coal D in the charges suggested the same conclusion. In this latter test, the first 40 charges were made of anthracite. At the start of this operation the metal was on the cold side and somewhat slow.

Air delivery, even at the start, was slightly below that desired, due to high back pressures, and after about half an hour of operation the air volume was falling off while windbox pressure remained at the maximum. Observations through the tuyeres, however, indicated that the coal was not decrepitating to any appreciable extent, which suggested that possibly bed height or fuel ratio was not correct.

In order to determine whether bed height was at

Fig. 2—Crew operating permanent mold casting equipment. Cupola using anthracite in right background.

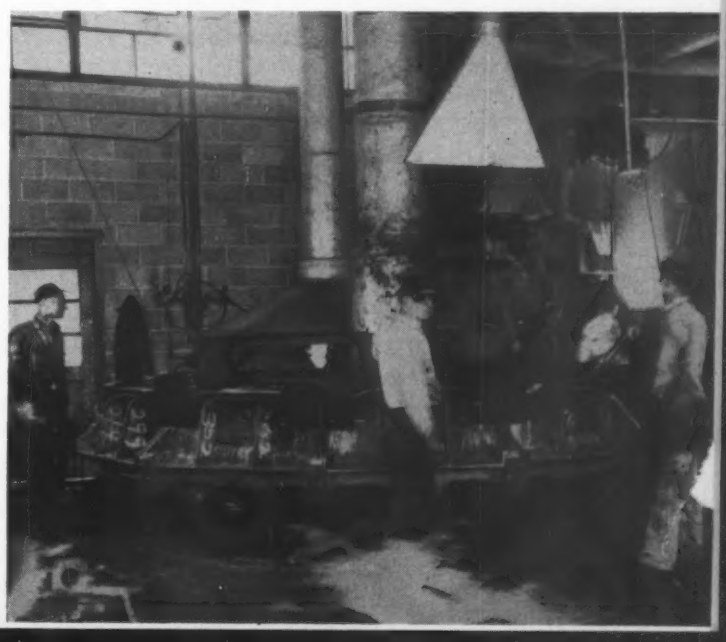


TABLE 4—TEST IN 30-IN. CUPOLA USING 100 PER CENT SMALL SIZE COKE NO. 2

Date	Fuel Ratio	Tonnage Melted	Pressure, oz	General Observations	Scrap In Process,[1] lb	Scrap Total, per cent
9/19	9½ : 1 and 9 : 1	28.9	11–20	Metal cold at start but improved	Not reported	—
9/22	9½ : 1	28.1	11–21	Fairly good temperature and fluidity	191	1.1
10/9	9½ : 1	30.4	11–21	Temperature good, fluidity fair	350	1.4
10/10	9½ : 1	29.2	Below 21	Metal on cold side most of day	370	3.2
11/12	10 : 1	30.5	13–21	Temperature generally low	225	1.9
11/13	10½ : 1	30.7	11–21	Temperature borderline to good	675	2.6
11/14	10 : 1	Not reported	13–19	Temperature and fluidity fair	Not reported	—

[1] Castings obviously defective when taken from the mold, i.e., mold not filled or casting cracked.

fault, a second test was run using 100 per cent of Coal D, but with the bed height reduced 6 in. to a total of 42 in. The operation was considerably improved for the first hour, but after about 2 hr of operation the pressure and air delivery reached blower capacity.

Metal temperature (thermocouple) started off rather low (2515 F) and gradually increased to the maximum of 2735 F, the highest recorded during the tests on this cupola. Because blast volume started to fall off while pressure was at the blower limit, the use of 100 per cent anthracite was discontinued with approximately two thirds of the day's charges in the cupola. Pressure remained near the maximum for the remainder of the day, but blast volume and temperature both held satisfactorily.

This test suggested that the fuel ratio must be too high and that fuel was accumulating in the cupola, thus causing the increase in pressure. In order to test this premise, these experiments were performed:

Over a 2-week period, the ratio was gradually increased from the 6½:1 ratio used for all coke operations to 8:1 when using 75 per cent of Coal D. Several days of fairly good operation with satisfactory temperature and fluidity were reported at this latter ratio. Before these tests could be carried to completion, the cupola was converted to three-table operation and the study had to be dropped.

Miscellaneous: Throughout the tests with high percentages of anthracite, it was observed that operations were somewhat less flexible with anthracite than with coke. Whether this was due solely to the pressure being at or near the limit of the blower cannot be stated. Undoubtedly, part of the lack of flexibility was due to excess fuel building up in the bed, part to the high melting rates desired and part to other factors.

Although not entirely conclusive, the tests with varying ratios indicate that when using authracite of quality comparable to that of Coal D, the substitution of anthracite for coke should be made on the basis of about 0.85 lb of anthracite per lb of coke rather than the 1:1 substitution generally practiced.

TABLE 5—TEST IN 30-IN. CUPOLA USING ANTHRACITE D AND COKE

Date	Anthracite, per cent	Coke No.	Fuel Ratio	Tonnage Melted	Pressure, oz	General Observations	Scrap In Process, lb	Scrap Total, per cent
9/17	26	2	9 : 1	28.7	Maximum	15-min shutdown for lack of metal. Good temperature and fluidity	No report	—
	50	2	9½ : 1					
9/18	50	2	9½ : 1	28.6	Maximum	5-min shutdown for repair of tuyere. Good temperature and fluidity	No report	—
9/23	40	2	9½ : 1	29.6	Maximum	Insufficient metal. Good temperature and fluidity	61	1.8
9/24	40	2	10 : 1	29.0	Maximum	Insufficient metal. Temperature good, fluidity fair	111	1.2
9/25	40	2	10 : 1	29.2	Maximum	10-min shutdown for repair of spout. Excellent temperature and fluidity	576	2.6
9/26	30	2	10 : 1	29.5	Maximum	Temperature good, fluidity fair	220	1.7
9/29	30	1-A	10 : 1	29.5	13–20	Excellent temperature and fluidity	94	1.3
9/30	30	1-A	10 : 1	29.7	Avg. 15–16	Excellent temperature and fluidity	368	2.1
10/2	30	2	10½ : 1	31.2	Maximum	Fair temperature and fluidity	220	2.1
10/3	30	2	10½ : 1	29.4	Maximum	5-min shutdown for blower repair. Temperature good, fluidity fair	210	1.0
10/8	40	2	10½ : 1	29.6	Maximum	Temperature and fluidity good	210	1.6
10/13	30	2	10½ : 1	33.6	Maximum	Temperature on low side	550	2.3

TABLE 6—TESTS ON 30-IN. CUPOLA USING ANTHRACITE C WITH COKE NO. 2

Date	Anthracite, per cent	Fuel Ratio	Tonnage Melted	Pressure, oz	General Observations	Scrap In Process, lb	Scrap Total, per cent
10/15	30	10½ : 1	30.7	12–17	Temperature and fluidity good	160	2.1
10/16	30	10½ : 1	31.5	12–21	Temperature and fluidity fair	476	2.7
10/17	40	10½ : 1	29.9	12–19	Low temperature for 1 hr due to excessive cut back on air volume	1110	5.2
10/20	40	10½ : 1	30.7	Below max.	Very low temperature at start and end of operation	1800	4.2
10/21	40	10½ : 1	30.7	Near max.	Fair temperature and fluidity	550	3.8
10/22	40	10½ : 1	30.5	Near max.	Fair temperature and fluidity	290	2.3

data on this coal:coke ratio would be most valuable.

It is important to note that throughout this series of test operations using from 30 to 75 per cent anthracite in the charges, adequate quantities of metal were supplied at unusually high melting rates per unit of cupola area, at temperatures and fluidities satisfactory for permanent mold casting, with no major change in operating routine and with remarkably low scrap.

Three-Table Operation—30-In. Cupola: The tests completed in the 30-in. cupola include the following:

Nine tests using 100 per cent small size Coke No. 2

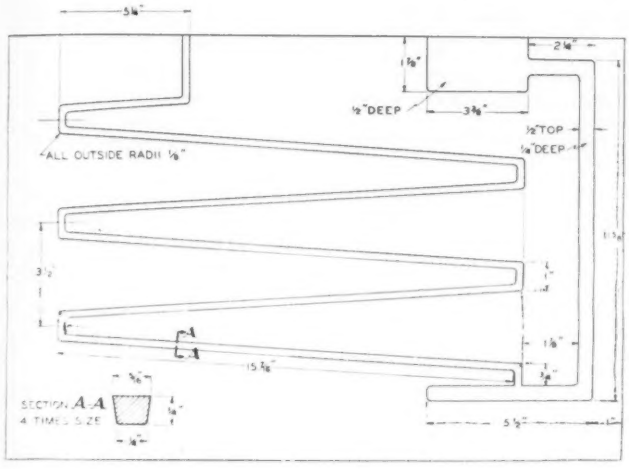
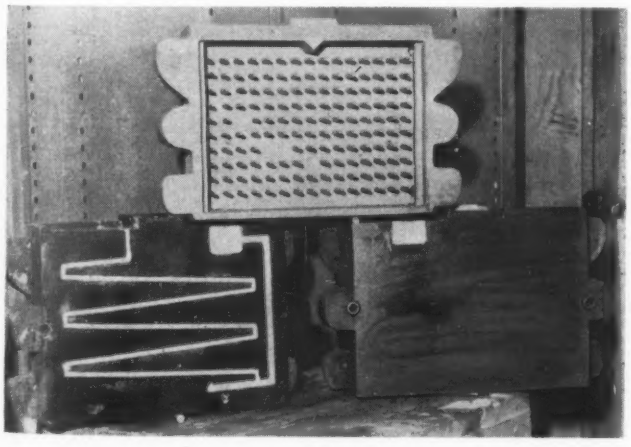


Fig. 3—(Above) Drawing of fluidity tets mold. Fig. 4—(Below) Parts of fluidity mold. Lower sections are mold halves. Top section is rear view.



at various fuel ratios. Results and general observations are shown in Table 4.

Twelve tests using Coal D at the fuel ratios and with the percentages shown in Table 5. Results in terms of pressure, temperature and general observation also are shown. All but two of these tests were made using the small size Coke No. 2.

Six tests were made using Coal C at the fuel ratios, and with the percentages shown in Table 6. General observations on results are included. All of these tests were made in conjunction with Coke No. 2.

Twelve tests were made using Coal B, five of these in conjunction with the small size Coke No. 2 and seven in conjunction with large size Coke No. 1A. Results and observations are shown in Table 7.

In terms of overall preformance for three-table operation, it is questionable whether the best conditions have yet been established. To date, the best results have been secured when using 70 per cent Coke No. 1A with 30 per cent Coal D at a 10:1 iron to fuel ratio. Coke No. 1A alone was not tried, so it impossible to state whether results would have been improved or fuel ratio changed with this fuel. Using Coke No. 2, which is somewhat variable in size, but generally considerably undersized, the results with 100 per cent coke were fair at ratios of from 9:1 to 10:1. The limited test data suggest a ratio of between 9:1 and 9½:1.

With Coal D and Coke No. 2, at ratios of 9½:1 and 10:1 and with 26 to 50 per cent of anthracite, insufficient metal and high pressures were experienced, but metal temperatures and fluidity were higher than normal. At 10:1 and 10½:1 and with 30 per cent of anthracite, pressures still were on the high side, temperature good to fair and general operation satisfactory. Using this anthracite it appears that with increase in anthracite percentages, the metal to fuel ratio should be increased slightly, and that a 10:1 or 10½:1 ratio is required at anthracite percentages of from 20 to 50.

With Coal C and Coke No. 2, at a ratio 10½:1, 30 per cent anthracite gave fairly good results with pressure as low as or lower than when using Coke No. 2 alone. When 40 per cent anthracite was used at the same ratio, pressures still were satisfactory but temperatures were either excessively low or borderline. From the rather limited data on this coal, a ratio of 10:1 at 30-40 per cent of anthracite would appear to be better than the 10½:1 ratio used in the tests.

With 40 per cent Coal B and 60 per cent Coke No. 2, at a 10½:1 ratio, excessive pressures and borderline temperatures resulted. These results indicate that this anthracite cannot be used in quantities as high as 40 per cent coal at the high melting rates employed for these operations, with this quality of coke. With the same coal and Coke No. 1A, however, 40, 50 and 60 per cent anthracite at ratios of 10:1 10:1 and 9½:1 were used with satisfactory pressure results. The temperature of the metal was on the low side, suggesting that ratios of 9½:1 or 9:1 would have been better.

Comparing the overall results, it is apparent that the quality of coke used is of considerable importance. With Coke No. 2 alone, the results were fair to borderline. With mixtures of Coke No. 2 and anthracite from different sources, the results were fair to poor depending upon the coal and the percentage used. With Coals C and D the results suggest that for the best performance the ratio should be increased (fuel decreased) slightly as the percentage of anthracite in the mixture is increased. With Coal B the ratio should be about the same as with Coke No. 2 alone, and quantities greater than 30 per cent result in excessive pressures.

When using Coke 1A, the percentage of anthracite can be increased to at least 40 per cent without any pressure difficulties and, although not tested, the results suggest the probability that considerably higher percentages of both Coals C and D could be employed at ratios requiring less fuel than when coke is used alone. With Coal B, 50 to 60 per cent of anthracite can probably be used at ratios equal to or requiring slightly more coal than with the Coke No. 1A alone.

A number of metal samples were secured, especially during periods when fluidity tests were being made,

TABLE 7—TESTS ON 30-IN. CUPOLA USING ANTHRACITE B AND COKE

Date	Anthracite, per cent	Coke No.	Fuel Ratio	Tonnage Melted	Pressure, oz	General Observations	Scrap In Process, lb	Scrap Total, per cent
10/24	40	2	10½ : 1	30.1	Maximum	One hour of low temperature, remainder fair.	550	3.2
10/27	40	2	10½ : 1	31.2	Maximum	Very poor operation, temperature low.....	3300	10.5
10/28	40	2	10½ : 1	31.2	Maximum	Borderline operation, temperature low.....	1260	4.3
10/29	40	2	10½ : 1+200 lb coke booster	31.5	Maximum	Borderline operation, temperature low.....	1615	6.6
10/30	40	1–A	10 : 1	31.5	12–15	Temperature and fluidity fair.....	502	3.1
10/31	50	1–A	10 : 1	31.8	12–18	Temperature and fluidity fair.....	186	2.1
11/3	50	1–A	10 : 1	31.7	Below max.	Two short periods of cold iron, remainder fair.....	460	2.4
11/4	50	1–A	10 : 1	23.0	12–17	Temperature on cold side; ½ day operation—Election Day.....	390	2.9
11/5	60	1–A	10 : 1	31.3	12–18½	Borderline temperatures.....	510	2.1
11/6	60	1–A & 2	9½ : 1	28.0	Avg. 18–19	Four shutdowns due to equipment failure. Temperature on low side.....	1420	5.0
11/7	60	1–A	9½ : 1	29.5	14–20	Temperature on low side.....	515	2.7
11/10	60	1–A	10 : 1	31.5	17–21	Two shutdowns not due to fuel. Temperature on low side.....	400	2.4

with a view to determining whether any significant changes were occurring in metal composition during a given test or as a result of changes in fuel used. A few typical data representative of the results secured are shown in Table 8.

A comparison of the metal analyses for the all-coke operation with those for operations with varying percentages of anthracite fail to show any major changes except for the test of August 13. On this date the ratio for the first 60 charges was 5.8:1 instead of 6½:1, and the metal does show a slightly higher average carbon content. Similarly, the analyses fail to show any significant trend in metal composition over the 8-hr period of operation.

Reporting Scrap

Twice during the period of test the foundry's method of reporting scrap was changed in an endeavor to arrive at a figure which would serve as a reasonably accurate indication of the results for a specific day. Unfortunately, specific types of castings from several days of operation frequently are accumulated and cleaned together, and it is thus difficult to trace the scrap back to a particular day of operation.

For this reason, two separate scrap figures have been reported—"total scrap" and "scrap in process." The latter figure probably is a more accurate measure of a particular day's operation, as it shows the percentage of castings rejected because of obvious defects such as broken rings, unfilled molds, etc., for the specific date reported. The former figure is the sum of "scrap in process" and the scrap from the cleaning operations on castings made two days previously.

For a 2-month test period during which varying percentages and types of anthracite were used, the type of castings and relative tonnage of each remained reasonably constant. Detailed data on scrap results for this period are presented in Table 9, together with general information on the fuel.

In judging these scrap figures, it must be remembered that these data include results for several days of operation when new ratios, percentages, and types of fuel were being studied. On a few of these days the scrap losses were relatively high and the foundry personnel considered the operations for the entire period as only fair. When compared with general foundry practice, however, the record shows a remarkably low overall scrap loss.

The high "scrap in process" on Oct. 10, Oct. 23 and Nov. 6 are not attributable to the use of anthracite and would probably have been much higher had an-

TABLE 8—DATA ON METAL SAMPLES FOR SELECTED PERIODS

Date 1947	Time	Anthracite,* per cent	Fuel Ratio	Fluidity, in.	Temperature, F (Thermocouple)	Analysis, per cent C	S	Mn	Si	P
7/10	10:00 a.m.	0	6.5 : 1	24½	2600	3.63	0.062	0.86	2.46	0.153
	11:30 a.m.			23½	2610	3.58	0.072	0.91	2.41	0.212
	1:45 p.m.			22	2610	3.47	0.060	0.94	2.50	0.224
7/11	9:30 a.m.	75 Coal C	6.5 : 1	20	2600	3.56	0.068	0.39	2.56	0.221
	12:30 p.m.			23	(?)	3.53	0.079	1.05	2.39	0.149
	1:30 p.m.			22½	(?)	3.60	0.077	1.09	2.48	0.155
7/16	9:45 a.m.	50 Coal B	6.5 : 1	20	2610	3.54	0.069	0.98	2.48	0.183
	10:15 a.m.			26½	2650	3.58	0.065	0.95	2.50	0.227
	12:15 p.m.			23½	(?)	3.56	0.057	1.30	2.66	0.221
	1:45 p.m.			26	2610	3.44	0.052	1.00	2.35	0.196
8/11	9:00 a.m.	50 Coal D	6.5 : 1	24½	2690	3.61	0.077	0.85	2.49	0.208
	11:00 a.m.			25½	2660	3.36	0.084	0.96	2.48	0.186
	2:00 p.m.			27	2690	3.69	0.083	0.89	2.41	0.227
8/12	9:30 a.m.	75 Coal D	6.8 : 1	19	2620	3.61	0.058	0.84	2.42	0.263
	10:30 a.m.			23	2625	3.68	0.078	0.98	2.46	0.218
	1:15 p.m.			28	2660	3.67	0.084	0.94	2.43	0.204
8/13	9:00 a.m.	78 Coal D	5.8 : 1	20	2535	3.72	0.069	0.88	2.38	0.198
	10:00 a.m.		6.5 : 1	—	—					
	11:30 a.m.		6.5 : 1	30	2680	3.73	0.074	0.92	2.27	0.232
	2:00 p.m.		6.5 : 1	23	2600	3.74	0.057	0.92	2.22	0.262

* Coke No. 1 was used 7/10/47 to 7/16/47; Coke No. 2 was used 8/11/47 to 8/13/47.

thracite not been used. On these three days a very small size of coke was used due to cleanup operations. The high scrap on Oct. 17 and 18 appears to be attributable largely to the choice of too high a ratio when using Coal C.

On both days most of the scrap resulted from low temperatures experienced at the end of the heat, which indicates insufficient fuel. The high scrap for the 3-day period, Oct. 27 to 29, is attributable to the use of too high a percenetage of Coal B with small size Coke No. 2, and also to the fact that the ratio was too high when using this particular coal. When used with quality coke this same coal at a reduced ratio showed scrap losses comparable with "normal" yields.

With the exception of the specific days noted, the scrap figures when using varying percentages and types of anthracite do not differ appreciably from the results when using 100 per cent coke of comparable quality to that used in the anthracite-coke mixtures.

Although detailed tests were not made on the performance of anthracite in the three larger cupolas in use at the Elmira Foundry, general observations were recorded. These larger cupolas are all lined to 45 in. inside diameter and are of the balanced blast type. Continuous tapping and slagging is employed with all three units, although one of the units frequently is shut down for periods ranging from 5 to 30 min. for reasons peculiar to the casting operations, which causes its operation to approach that of an intermittently tapped unit. Normal operation for each cupola is 8 hr.

Over the period observed, fuel ratios were varied from 4:1 to as high as 10:1 depending upon the type of metal required and the melting rate desired. Melts ranging from high-strength iron to gray cast iron were made. Anthracite percentages ranging from 20 to 80 per cent of the charges have been used, with 30 to 50 per cent the general practice. No change in ratio or operating routine was made when anthracite was used except for the substitution of anthracite for coke in the charges, and for some operations an increase of 25 to 50 per cent in the quantity of limestone added.

In general, the results with the anthracite coke mixtures were somewhat less flexible than when using good quality coke, due to the increase in windbox pressure occasioned by the use of the anthracite. Coke No. 1A was used in conjunction with all the anthracites described in Table 1, and the overall results appeared to be most satisfactory with Coals B, C and D. Coal A was unsatisfactory because of its small size and its marked tendency to increase windbox pressure.

Although decreasing the flexibility of the operation, the increase in pressure was not as serious with these large cupolas, because the larger size Coke No. 1A was used at all times and because these units have blowers capable of carrying some overload. Melting rates, metal temperatures and metal quality appeared to be satisfactory for the types of castings required, which varied considerably in size, complexity, and

TABLE 9—DATA ON SCRAP FOR PERIOD 9/22/47 TO 11/13/47

Date	Anthracite Source	Anthracite Per Cent	Coke No.	Ratio	Bed Height,† in.	Melt, tons	Yield* Castings, tons	Scrap Castings—Percentage by Weight of Good Castings Total	In Process
9/22	—	0	2	9½ : 1	42	28.1	20.4	1.1	0.47
9/23	D	40	2	9½ : 1	42	29.6	20.7	1.8	0.15
9/24	D	40	2	10 : 1	42	29.0	20.6	1.2	0.27
9/25	D	40	2	10 : 1	42	29.2	21.0	2.6	1.37
9/26	D	30	2	10 : 1	42	29.5	21.2	1.7	0.52
9/29	D	30	1–A	10 : 1	42	29.5	21.7	1.3	0.22
9/30	D	30	1–A	10 : 1	42	29.7	21.7	2.1	0.85
10/1	D	30	2	10 : 1	42	29.2	21.8	1.0	0.28
10/2	D	30	2	10½ : 1	42	31.2	22.1	2.1	0.50
10/3	D	30	2	10½ : 1	42	29.4	21.7	1.0	0.40
10/6	D	30	2	10½ : 1	42	31.2	22.0	2.2	1.19
10/7	D	30	2	10½ : 1	42	29.4	22.0	1.9	0.84
10/8	D	40	2	10½ : 1	42	29.6	21.6	1.6	0.49
10/9	—	0	2	9½ : 1	42	30.4	22.5	1.4	0.78
10/10	—	0	2	9½ : 1	42	29.2	21.4	3.2	2.02
10/13	D	30	2	10½ : 1	42	33.6	22.9	2.3	1.10
10/14	Mixed	30	2	10½ : 1	42	30.9	23.4	2.3	0.73
10/15	C	30	2	10½ : 1	42	30.7	22.5	2.1	0.35
10/16	C	30	2	10½ : 1	42	31.5	22.7	2.7	1.05
10/17	C	40	2	10½ : 1	42	29.9	21.7	5.2	2.56
10/20	C	40	2	10½ : 1	42	30.7	21.4	5.5	4.20
10/21	C	40	2	10½ : 1	42	30.7	22.0	3.8	1.25
10/22	Mixed	40	2	10½ : 1	42	30.5	22.0	2.3	0.66
10/23	Mixed	40	2	10½ : 1	42	29.9	21.3	4.2	2.77
10/24	B	40	2	10½ : 1	42	30.1	22.2	3.2	1.24
10/27	B	40	2	10½ : 1	42	31.2	20.0	10.5	8.33
10/28	B	40	2	10½ : 1	42	31.2	21.8	4.3	2.89
10/29	B	40	2	10½ : 1	42	31.5	20.9	6.6	3.87
10/30	B	40	1–A	10½ : 1	48	31.5	22.5	3.1	1.11
10/31	B	50	1–A	10 : 1	48	31.8	22.9	2.1	0.41
11/3	B	50	1–A	10 : 1	48	31.7	22.2	2.4	1.04
11/4	B	50	1–A	10 : 1	48	23.0	16.7	2.9	1.17
11/5	B	60	1–A	10 : 1	48	31.3	22.5	2.1	1.13
11/6	B	60	Mixed	9½ : 1	48	28.0	18.9	5.0	3.75
11/7	B	60	1–A	9½ : 1	48	29.5	21.3	2.7	1.2
11/10	B	60	1–A	10 : 1	54	31.5	22.2	2.4	0.9
11/11	B	60	1–A	10½ : 1	54	30.5	22.2	2.9	0.8
11/12	—	0	2	10 : 1	54	30.5	22.8	1.9	0.5
11/13	—	0	2	10½ : 1	54	30.7	22.1	2.6	1.1

* The total number of individual casting produced ranges from about 6,000 to 9,000 per 8-hr day.
†Bed height above top of main tuyere.

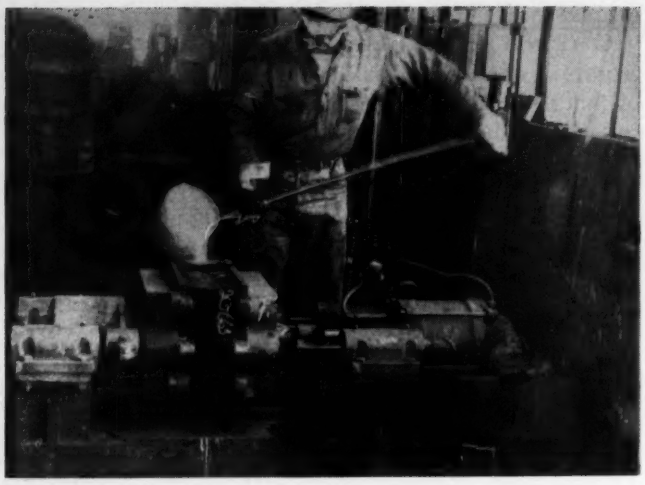


Fig. 5—Pouring metal into mold for fluidity test.

metal analyses. Approximately 2500 tons of anthracite were used in these units during 1947.

Summary and Conclusions

A fluidity test for particular application to the permanent mold operations has been developed and tested under a variety of conditions, and found to give reproducible results.

A method of accurately measuring metal temperatures was investigated and the results compared with temperature measurements using optical pyrometers. The use of a platinum platinum-rhodium thermocouple encased in thin wall fused silica protection tubes gave rapid and accurate temperature readings. The life of the silica protection tubes under the combined action of high-temperature metal and slag was insufficient to justify the use of this method for control purposes, but as a standard or as a research tool the method is excellent.

Cupola performance was investigated using varying percentages of anthracite in three different sizes and from four different collieries, in conjunction with two different cokes, in a cupola lined to 24 in. inside diameter and later relined to 30-in. inside diameter.

In the 24-in. cupola from 30 to 75 per cent anthracite in the charges was used at metal to fuel ratios as low as or lower than when all coke was employed. Adequate quantities of metal were produced at unusually high melting rates per unit of cupola area, with temperatures and fluidities satisfactory for permanent mold casting, with no major change in operating routine and with remarkably low scrap losses.

Tests using 100 per cent of anthracite were attempted with two of the coals, but with unsatisfactory results at the high melting rates required. Fuel-bed resistance generally was higher than with coke alone, and was the limiting factor in determining the percentage of anthracite that could be substituted for coke. The anthracite operations were in general less flexible than when using coke alone, and required closer control on the part of the cupola operator.

This was due partly to the higher pressures resulting from higher fuel-bed resistance. Neither the percentage of anthracite nor the fuel ratios giving the best results were the same for all the coals tested. The low volatile, hard structure coal showed the best results.

In the 30-in. cupola at the high melting rates required, the performance was largely dependent upon the quality of the coke with which the anthracite was used. With small size coke the limiting quantity of anthracite was fixed by fuel-bed resistance at about 40 per cent. With large foundry coke, up to 60 per cent of the anthracite which normally showed the highest fuel-bed resistance was used satisfactorily.

In general, the anthracite-coke mixtures in the 30-in. cupola gave performance comparable to that obtained from the coke with which the anthracite was used. At with the operations in the 24-in. cupola, however, the anthracite operations required more careful attention on the part of the cupola operator because of the higher fuel-bed resistance and lack of sufficient leeway in quantity of air available.

Metal analyses showed that no significant changes in metal composition occur under normal operation over the regular 8 hr of cupola operation. Similarly, the metal analyses for coke and for coke-anthracite mixtures, with up to 75 per cent anthracite, showed no significant differences at comparable fuel ratios.

The melting rates obtained from the permanent mold cupola are appreciably higher than the rates considered "normal" for cupolas lined to the sizes used. Since at a fixed fuel ratio a given melting rate requires a fixed volume of air, it follows that the air velocity must be higher than "normal" in this unit. The same melting rate per hour could be secured at a lower melting rate per unit of area with a lower velocity by air, hence, lower fuel-bed resistance by slightly increasing the diameter of the cupola.

Any decrease in air velocity would be especially advantageous when using anthracite because all the difficulties encountered can be traced for the most part to high fuel-bed resistance. The installation of blowers capable of delivering air against a higher back pressure would also be advantageous.

Acknowledgments

This investigation was conducted as one phase of a general research program on new and improved uses for anthracite, sponsored jointly by the Commonwealth of Pennsylvania and the Anthracite Institute, and conducted by the Division of Fuel Technology of The Pennsylvania State College under the jurisdiction of the Pennsylvania Department of Mines. The authors are deeply indebted to the management and personnel of the Elmira Works, Apparatus Division, General Electric Co., for permission to conduct the tests and for their wholehearted cooperation and interest in the performance of the experimental work; to Adam Mahonske for his advice and assistance in developing the fluidity test and in planning and executing the research program; to J. J. Hassett, Jr., of the Elmira Coal Co. and E. J. Bourger of the Hudson Coal Co. for very material assistance in the execution of the test work; and to C. D. Nuebling, Sr., and Harold Lovell of the Division of Fuel Technology for the analytical data on fuels and metals herein reported.

References

1. J. F. K. Brown, *Transactions*, 3rd Annual Anthracite Conference, Lehigh University, 193 (1940).

2. J. F. K. Brown, and E. E. Roecker, *Transactions*, 4th Annual Anthracite Conference, Lehigh University, 67 (1941).

3. C. C. Wright, *Transactions*, 5th Annual Anthracite Conference, Lehigh University (1947), and AMERICAN FOUNDRYMAN, Nov. and Dec., 1947.

FOUNDRY SANDS EVALUATED

Naturally Bonded Vs. Synthetic Sands

C. A. Sanders
Engineer
American Colloid Co.
Chicago

IN ANY DISCUSSION of naturally bonded and synthetic sands, it cannot be fairly debated as to which is the better sand because of the many factors to be considered. The author intends to give an unbiased opinion on the characteristics of the two types of sand, showing their advantages and disadvantages, and bring out the hidden potentialities of each.

Either of the two types of sand may be criticized as to chemical composition and physical properties. Both sands must possess high refractoriness, especially if used for steel castings. Immediately some foundrymen will reply that naturally bonded sands are never used for steel castings, but the author wishes to refer them to the British foundrymen who have and are using natural sands for casting steel. In the United States, steel foundries employed naturally bonded sands until discovering the many advantages of using the pure, washed and graded sands which constitute the base of synthetic sands as known today.

In 1922, Dr. P. G. H. Boswell, after visiting various United States foundries, returned to England and published a booklet entitled, "British and American Foundry Practice." He emphasized that English foundries should retain the naturally bonded sands, but urged that, in view of the immense advantage likely to accrue from standardization in a synthetic method, investigations and trials be made to determine the advantages of this new practice. Even today in the United States some use is made of the natural sands in the steel foundry.

Ceramic Chemistry

Chemically, all sands should have a negligible quantity of low-fluxing compounds present, as it is quite easy to form various silicates with the alkalies of sodium, potassium, and various alkaline earths such as calcium and magnesium alkalies. It is difficult to assign limits as to the permissible quantities of these respective oxides, and it is for this reason that many prominent foundrymen have frowned upon the use of naturally bonded sands.

Natural sands usually come into the shop in impure form, and possess a low sintering point. Potash and soda usually are found in combination with alumina and silica in the form of undecomposed alkali feldspars and mica, which are easily broken down on heating. The resultant vitrification point is much lower. Some of the early naturally bonded steel molding sands did possess potash and soda, but these were found in minute quantities and possibly were in the form of finely divided secondary micas. Sands of this classification had but very little tendency to burn-on.

Lime and magnesia usually are found in bonded sands, bank sands, and some lake sands, but the lime usually is found in combinations with alumina, silica or soda, forming lime feldspars or lime-soda feldspars. Since the carbon dioxide is not present, little calcium carbonate is determined. Many foundrymen are reluctant to use sands which show lime content, but lime is not detrimental unless it is too abundant and occurs in unsuitable form.

In support of these findings, attention is called to the various precipitated calcium carbonate partings used in the foundry, or to the various calcium mold washes which are used on certain mold facings, or the practice of adding lime directly to facing sands to obtain certain physical properties. These cases are cited only to eliminate the fear of using certain foundry sands because they possess minor amounts of lime. In some cases the proportion of lime to soda present would be just about that required for the basic feldspar mineral, labradorite.

Some sands are found to possess fine micaceous aggregates of chlorites, chloritoids, magnesia, and ferromagnesia micas. Also found are traces of biotite, olivine, the pyroxenes (augite, etc.) and hornblende. Serpentine, talc and the amphibole group of minerals are sold to the foundry trade under several commercial brand names and used freely. Alumina is present in natural sands in the form of clay of theoretical composition $Al_2O_3 \cdot 2\ SiO_2 \cdot 2H_2O$, and as gibbsite (hydrargillite) $Al_2O_3 \cdot 3H_2O$.

It has been found that some of the alumina indicated by analysis may be combined with the alkalies and lime in the form of micas and feldspars. Alumina, then, whether silicated or hydrated, assists in producing the bond of the sand. About 8 per cent alumina in bulk analysis appears to be average for good natural sands.

Ferric oxide (Fe_2O_3) usually predominates the iron oxides in natural sands. If in excess, it promotes fluxing by the formation of silicates of iron. Under reducing conditions, ferrous silicate is produced and fluxing takes place. Whether it is detrimental or an asset is debatable, as much iron oxide is used to increase hot strength for certain castings. Slight amounts of ferric oxide have been found in the form of limonite of compositions between $2Fe_2O_3 \cdot H_2O$ and $Fe_2O \cdot 2H_2O$. The presence of the anhydrous oxide, Fe_2O_3 (hematite), has been established in many natural sands.

Combined water occurs in the minerals mentioned, that is, water liberated from combination at temperatures substantially above 110 C, below which hygroscopic water is driven off. The combined water is associated with the alumina, limonite, feldspar, gibbsite, etc., but the bulk with the mineral kaolinite.

The part played by other minor constituents in natural or synthetic sands has not been determined, but these may act as catalysts and promote combinations of elements. The minor elements sometimes are not determined, but are found in very minute quantities. Their presence or absence is not important, but most successful sands have limited impurities.

Mechanical and Physical Properties

The second phase of determining or grading a naturally bonded sand is the mechanical or physical composition. Many features of sands are debated from this standpoint, but the author intends to list the important characteristics that should be studied.

By far the most important sand characteristic is the size of the constituent sand grain and its shape. The percentage by weight of the grains retained on standard screens is important. The grain distribution or grain spread is the percentage by weight of each portion between certain agreed limits of each screen size and illustrates the potential ability of the sand.

In a former article, "Controlling Sand Grain Distribution," which appeared in the April, 1948, issue of AMERICAN FOUNDRYMAN, the expression in curve form of the results of mechanical screening of the sands brings out the contrasts and similarities more strikingly than do illustrated tables. A graph serves to visualize a list of figures; and if a master graph of the system is used to coincide daily charts, the tendency of the sand curve to bend can be observed and the system corrected.

Composition of accompanying vegetation influences the mechanical properties of natural molding sands, and good examples of this effect are the deposits of Albany sand carrying much humus material, giving them good workability. The water of plasticity or water-holding capacity quickly identifies good foundry sands. Likewise, the property of giving-up moisture or transmitting moisture should be studied.

Many foundrymen refer to some sands as "potato-mud." The "potato-mud" sands are those which soak water like a sponge and hold it on the surface of the mold. Much burn-in results and the dry strengths of the sands are extremely high due to the excess water. These sands dry in hard lumps, the same as a farmer's potato furrow if the field has been plowed when wet.

A recent trend in synthetic sand mixtures is the addition of wood flour to furnish "humus" to the system, and to take up the excess moisture. This is needed in certain synthetic mixtures.

The common physicals such as permeability, clay substance, A.F.S. Grain Fineness, distribution, classification, durability, green, dry, and hot strengths, help to catalogue the numerous naturally bonded sands.

Properties of Naturally Bonded Sands

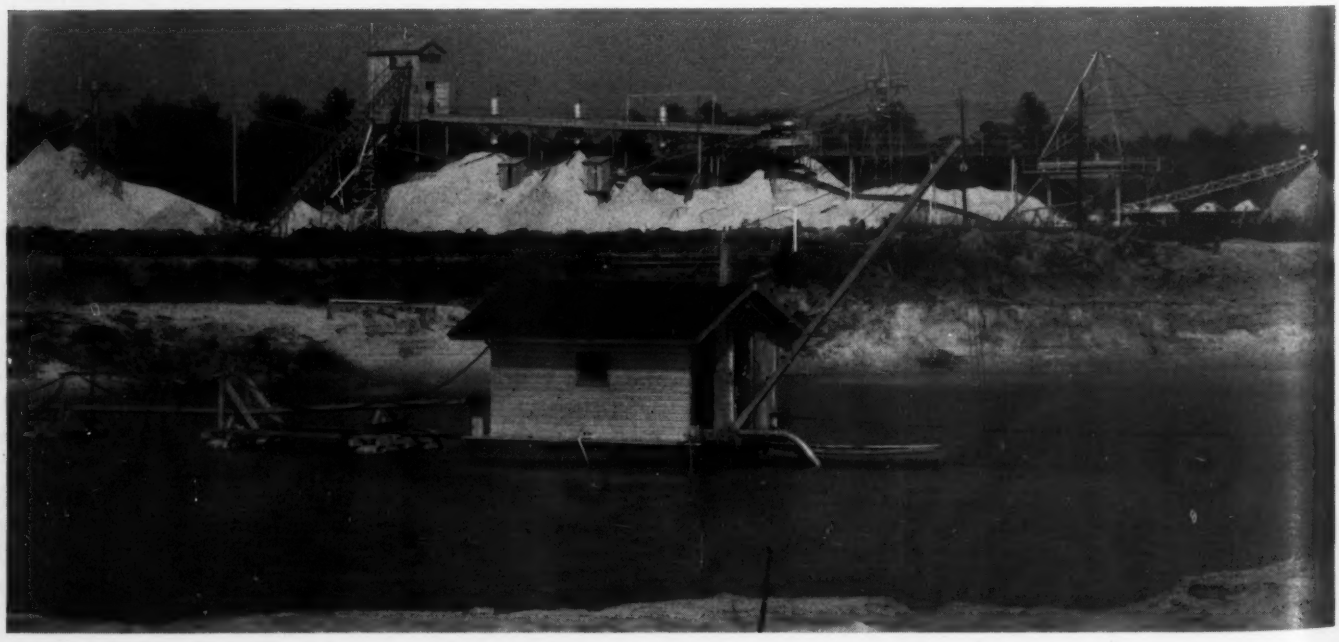
1. Naturally bonded fine-grained sands are used in nonferrous foundries as well as in gray iron foundries casting enamelware, hardware, sanitary ware, ornamental fittings, and gray iron stove plate. It has been conceded that these "velvet feeling" sands give excellent finish, but arguments have arisen as to why.

Yesterday's craftsmen explain that if the bond is ferruginous, a smooth blue skin is obtained. Further, they state that the presence of vegetation or humus results in a more suitable atmosphere when the mold is being filled by metal. At present, this thought is being given much attention.

2. Since bond must be added to synthetic sands, it has been held that naturally bonded sands have been "blessed by nature." It is explained that the ideal condition of the bond is in the state of pellicles, as thin as possible, enveloping each of the siliceous grains. This condition is difficult to erect artificially. Most naturally bonded sands seem to possess these qualities.

3. Jobbing foundries have acclaimed the naturally bonded sands for their unusual ability to retain moisture for a longer period of time. The water-holding

General view of a washed silica sand plant. Sand is dredged through pipe in foreground and deposited on stockpile.



capacity is at a maximum in naturally bonded sands, as the bond is well distributed.

Each envelope of water and hydrated iron oxide (if present) tends to hold a skin or envelope of water, and the surface tension knits the sand in a firm yet elastic mass. Resilience is thus obtained, allowing the mold to bend upon use without cracking and yielding with the metal under expansion and contraction. Naturally bonded sands are less sensitive than either fireclay or bentonite bonded sands.

4. It may be debated that for the reason given directly above, No. 3 may be classified as either an advantage or disadvantage. Likewise, the distinguishing feature of these sands is to absorb and adsorb (on surface) water without really becoming wet.

The range of this property differs with various sands, yet the range is quite wide. To offset the disadvantage, the foundryman explains that molds are more easily patched, tooled, and finished, because of this characteristic. Pit molding is extremely difficult if rapid drying of the mold takes place.

Difficulty in Maintaining Standards

5. Since they are of sedimentary deposition, it is difficult to maintain standards for naturally bonded sands when shipped at different periods from different sections of the pit. They are liable to variation in the field, and differences in composition and grain size.

Some natural molding sands are high in impurities such as organic matter, feldspar, unweathered mica, and, if near lime deposits, will be contaminated with calcium carbonate. These impurities usually are ground into the silt content, which interlocks with the clay grain. However, most natural sand producers now do not ship "mine-run" sand, but blend sands and segregate the sand bed. Sands are now closely ordered by clay content and are more uniform.

6. A carload of naturally bonded sand may be thrown onto the foundry floor and used without extensive mechanical preparation. This is not true with synthetic sands; they must be given much attention. As one well-known sand salesman remarked, "If the average foundry controlled its naturally bonded sands as it does synthetic sands, casting results would be so improved."

7. The clay content of the average naturally bonded sand has a fusion point of approximately 2400 to 2500 F, and many have tested as low as 2200 F by the B-Sintering Test. The clay is of a type that exerts low initial bond strength and dehydrates readily, losing its plasticity rapidly. Because of this behavior, the natural sands must have from three to four times as much clay substance as the average synthetic sand. The silica portion also has a lower refractoriness than a high quality silica sand used in synthetic practice.

8. It is quite difficult to draw a line between clay content and clay substance in natural sands. Clay substance usually includes fine sand, super fines, and silt. But, the proportion usually is low.

9. Because of their low durability, naturally bonded sands are difficult to reclaim. Much new sand must be added to bring back strength, and yet the calcined portion remains in the heap as fines. As the heap closes, more new sand is added to "open" it, which is expensive. Natural sand with low pan material rebonds better without balling than high pan material natural sand.

10. Floor type foundries usually frown on employing synthetic sands, as without proper sand preparing equipment synthetic sands cannot function properly. In addition to a muller, conveyors, elevators, storage hoppers, etc., are required.

11. Some foundries, with limited storage space for system sand, offer a market for naturally bonded sands. Other foundries, lacking space for storing naturally bonded sands for winter use, may purchase washed and dried sand at any time and rebond it with bentonite or fireclay.

12. Companies which are not equipped for proper sand control generally use naturally bonded sands, yet sand control even with naturally bonded sands is an asset and helps to eliminate many casting defects.

13. Reserves of well-known brands of naturally bonded sands are diminishing and certain available quantities are limited. As stated by Anselman,[5] "The Albany sand gained its reputation in early days in the stove plate foundries where the iron was poured at approximately 2550 to 2600 F, and was fluid at this temperature due to the high phosphous content in the metal. However, today in the modern stove shop where we are pouring at temperatures around 2800 F, this sand is not entirely satisfactory, first because there is a fusion of the sand at this temperature, and second, because it has too much pan material to withstand the hard ramming under mechanical methods such as jolt squeeze or slinger work.

"Today, a more open sand is used with a high silica-base grain to withstand the temperature and a clay that is soft, not too durable, but one that will give the desired properties for a hard-rammed sand. This softening, or partial fusion, at a low temperature in the Albany type sand is what gives it its ability to withstand expansion troubles, which reduces rattails, buckles and scabs."

Synthetic Molding Sands

Nature has been very kind and has done a splendid job in furnishing sands substantially clay-free and suitable as a base sand for a synthetic mixture in the foundry. Rather than discuss the geological history of the sands in this group, it is the intent to be concise.

Natural deposits of substantially clay-free sands are due principally to the actions of glaciers, rivers, creeks, streams, winds and lakes. As the glacier moved forward, it carried vast quantities of ceramic materials of various chemical and physical compositions, as well as variations in grain size. These materials were deposited in front of the ice sheet. As the glaciers melted, the small streams transported these materials into the larger streams, and they, in turn, into rivers and lakes. Heavily charged streams or rivers acted as classifiers and, as the waters meandered or spread out, lost velocity and the sedimentary materials were deposited.

It is evident that the coarsest materials were deposited first. As the water became less turbulent, the finer grains with less specific gravity were settled. From various silica areas, stratified layers tell the story of this migration which was completed many thousands of years ago. Through the historic years, nature's currents have swept along the watery shores and have transferred sand to different deposits. This transportation has resulted in the development of a succession of beaches, deltas, and nature's queer formations.

Many of these deposits have emerged above the levels of various waters, and have suffered repeated attacks of wind, rain, snow, and various storms. All of this action has resulted in cleaning and sorting the various sands. Wind has played an important part in the development of bank or dune sands.

Only those sands which have been properly prepared by nature, principally the laying down of beds of uniform grain size, are of importance in foundry use. Many good molding sands of similar characteristics can be substituted successfully in the sands formulas, but wise foundrymen depend upon the nearest available and dependable source of supply.

Control and Economy

Synthetic sand usage has advanced rapidly in recent years, but this increase has been due to developments in sand control. It is the ease with which synthetic sands can be controlled that has made them so important to the foundry. No other sand can show such

Loading trucks at a core sand bank.

economy as synthetic sands when tons of castings produced are compared with tons of molding sands used.

Years ago, natural molding sands were used because the idea of synthetic mixtures had not been developed. Today, foundrymen have learned the advantage of taking a base sand of high purity and, by adding a bonding agent in the correct proportions, obtain the physical properties which will enable them to produce a satisfactory casting and eliminate many defects.

A synthetic sand possesses a higher refractory value than a naturally bonded sand, principally because of the purity of the silica sand grain. This silica grain, properly blended with a minimum amount of clay bond, insures refractoriness above 3,000 F.

It has been pointed out that naturally bonded sands tend to cling or burn-on the casting because the high clay content affects the eutectic point of the silica-alumina combination and the sintering point is reduced. Natural molding sand varies in clay substance or clay content but, on the whole, exceeds the required bond of synthetic mixtures to obtain the same strengths. The efficiency of synthetic clay bond can be readily seen.

The enormous output of steel, gray iron and malleable castings in America could never have been obtained if synthetic sands had not aided in mass production. Steel casting requires sands of high refractoriness, sand venting power, and other properties furnished by synthetic sands.

Properties of Synthetic Molding Sands

1. By far the most important advantage of synthetic sands is that of economy.

2. Uniformity of grain size and grain distribution is easily controlled.

3. Because of the higher permeability and venting value of synthetic sands, molds may be rammed harder, thus eliminating swells, cuts, washes, and other defects associated with soft ramming. Castings are held within closer tolerances, and pattern dimensions are maintained. Similar claims are made for some naturally bonded sands.

4. Higher refractoriness results in cleaner castings.

5. Many foundries have found that synthetic sands are more friable and brittle than naturally bonded sands, making patching and repairing of the mold more difficult. Molds left standing are more easily damaged.

6. The average natural molding sand requires from 100 to 220 per cent more temper water than synthetic sands bonded with strong clay bonds. It has been pointed out that synthetic sands dry out faster than naturally bonded sands because the sharp silica grains are more permeable. It is not a case of synthetic sands drying out faster than naturally bonded sands, but rather a case of each losing the same amount of moisture in the same period of time.

While the naturally bonded sand contains from 6 to 8 per cent working moisture content, many synthetic sands contain only 3 per cent working content; therefore, if one per cent is subtracted from each of the two sands it can be readily seen that the effect is greater on the synthetic sands than on the naturally bonded sands.

The moisture range of synthetic sand is quite narrow, but this may be given as an advantage as well as a disadvantage. Since sands turn over so rapidly in the foundry, synthetic sands maintain their moisture for the required period of time. Low moisture means less oxidizing atmosphere in the mold cavity during casting.

7. There is no one-purpose sand in any foundry, unless the foundry produces only one product or a group of similar products. Sacrifices must be made in physical properties if one sand is used for all jobs. Synthetic sands can be easily varied by blending various grades, and lend themselves to a variety of physical changes. By employing one coarse and one fine silica sand, less stowage space is required. Desired physical properties are easily obtained.

8. Castings clean easier because the silt, fine sand, and superfine material is controlled.

9. Some of the elder molders claim that the lack of colloidal hydrated ferric oxide in the washed and dried silica sands results in weaker sands, and that stripping of the mold at the shakeout is difficult.

10. Synthetic sands are more durable because little new bond is required to rejuvenate the system.

11. A closer control is possible with synthetic sand which results in lower scrap losses.

12. Many foundries are built near deposits of high grade silica sand, particularly in Michigan, Ohio, New

Jersey, Pennsylvania, Illinois and Wisconsin where the heavy tonnages of castings are produced. Hence, the supply is practically unlimited and delivery costs low.

Summary

Each sand, whether synthetic or natural, has a definite place in the foundry industry. In order to combine ease of control, economy, proper grain distribution, cooler sands, flowability, longer range of moisture retention, workability and other qualities required to produce a good casting, the author believes that the use of a semi-synthetic sand (part natural and part synthetic sand) with the proper mold cavity atmosphere will solve many foundry sand problems.

Bibliography

NATURALLY BONDED SANDS

J. Covan, "Durability of Natural and Synthetic Sands," A.F.A. TRANSACTIONS, vol. 50, pp. 539-567 (1942).

R. E. Grim, "The Clay Substance in Natural Sands," A.F.A. TRANSACTIONS, vol. 47, pp. 935-956 (1939).

J. J. SHEEMAN, "Sand Control in the British Foundry Industry," A.F.A. TRANSACTIONS, vol. 48, pp. 766-774 (1940).

Workmen remove top soil to expose Albany sand bank.

J. J. Boland, "Testing of Foundry Sand and Its Coordination with Molding Results," A.F.A. TRANSACTIONS, vol. 49, pp. 730-748 (1941).

Anon., "Chemical Composition of Bonding Substance in Molding Sands," *The Brass World*, vol. 21, April, 1925, p. 120.

E. S. Ash and E. O. Lissell, "Some Fundamental Aspects of Foundry Sands," *The Foundry*, vol. 69, no. 7, July, 1941, pp. 60-61, 118-119; no. 8, Aug., 1941, pp. 60-61, 130-131.

H. Ries, "Report of Subcommittee on Geological Investigation of Molding Sands," A.F.A. TRANSACTIONS, vol. 30, 1922, p. 855, and vol. 31, 1923, p. 669.

C. A. Hansen, "Physical Properties of Foundry Sands," A.F.A. TRANSACTIONS, vol. 32, p. 57 (1924).

C. M. Nevin, "Notes on Grading of Sands with Special Reference to Albany Sands," A.F.A. TRANSACTIONS, vol. 32, p. 182 (1924).

C. M. Nevin, "Life of Molding Sands," A.F.A. TRANSACTIONS, vol. 33, p. 763 (1925).

H. J. Cole, "Comparison of Natural Bonded and Synthetic Molding Sands for Steel Foundry," A.F.A. TRANSACTIONS, vol. 39, p. 161 (1931).

H. W. Dietert and Earl Woodliff, "A Study of Non-Ferrous Molding Sands," A.F.A. TRANSACTIONS, vol. 45, p. 82 (1937).

Jack Covan, "Comparison Data on the Durability of Naturally Bonded and Synthetic Molding Sands by the Repeated Pour Test," A.F.A. TRANSACTIONS, vol. 50, p. 539 (1942).

SYNTHETIC SANDS

H. Ries, "Foundry Sand," A.F.A. TRANSACTIONS, vol. 48, pp. 657-666 (1940).

J. E. Hurst, "Green and Dry Sand Molding," *The Foundry*, vol. 74, Feb., 1946, p. 97.

R. F. Holby and H. F. Scobie, "Recent Experiments with Gray Iron Synthetic Molding Sands," A.F.A. TRANSACTIONS, vol. 48, pp. 465-480 (1940).

N. J. Dunbeck, "American Synthetic Sand Practice," A.F.A. TRANSACTIONS, vol. 49, pp. 141-164 (1941).

N. J. Dunbeck, "Drying Out of Synthetic Sands," A.F.A. TRANSACTIONS, vol. 50, pp. 937-952 (1942).

R. E. Morey and H. F. Taylor, "Properties of Synthetic Bonded Steel Molding Sands," A.F.A. TRANSACTIONS, vol. 49, pp. 388-426 (1941).

R. Webster and A. C. Den Breejen, "Sand Reclamation," A.F.A. TRANSACTIONS, vol. 53, p. 138 (1945).

D. D. Cameron, "Advocates Rounded Grain Sands," *The Foundry*,, vol. 63, no. 4, April, 1935, pp. 31, 62.

R. J. Doty, "Study of Change in Grain Size of Silica Sand Through Constant Addition of Clay," A.F.A. TRANSACTIONS, vol. 30, p. 782 (1922).

D. W. Trainer, "Geology of Molding Sand Deposits," A.F.A. TRANSACTIONS, vol. 33, p. 797 (1925).

C. A. Hansen, "Grading of Molding Sands," A.F.A. TRANSACTIONS, vol. 34, p. 373 (1926).

F. C. Scheiber, "Synthetic Molding Sands in the Malleable Foundry," A.F.A. TRANSACTIONS, vol. 35, p. 138 (1927).

P. W. Crane, "Sands Used for Different Classes of Work," A.F.A. TRANSACTIONS, vol. 36, p. 734 (1928).

E. W. Smith, "Theoretical vs. Practical Studies of Foundry Sands," A.F.A. TRANSACTIONS, vol. 37, p. 589 (1929).

George Batty, "The Most Potent Variable," A.F.A. TRANSACTIONS, vol. 38, p. 309 (1930).

Future Meetings and Exhibits

NATIONAL ASSOCIATION OF FOREMEN, 25th Annual Convention, Convention Hall, Philadelphia—September 23-25.

ASSOCIATION OF IRON & STEEL ENGINEERS, Annual Convention, Public Auditorium, Cleveland—September 28-October 1.

ALL-CANADIAN FOUNDRY CONFERENCE, Montreal, Quebec, Canada—September 30-October 1.

MICHIGAN REGIONAL FOUNDRY CONFERENCE, Michigan State College, East Lansing, Mich.—October 1-2.

NEW ENGLAND MATERIALS HANDLING EXPOSITION, Mechanics Hall, Boston—October 5-7.

ASSOCIATION TECHNIQUE DE FONDERIE, 22nd Annual Congress, Paris, France—October 8-9.

AMERICAN SOCIETY OF TOOL ENGINEERS, Semi-annual Convention, Pittsburgh—October 10-12.

AMERICAN CHEMICAL SOCIETY, National Exposition, Coliseum, Chicago—October 12-16.

MAGNESIUM ASSOCIATION, Midyear Meeting, Skytop Club, Skytop, Pa.—October 13-14.

GRAY IRON FOUNDERS SOCIETY, Annual Meeting, Atlantic City, N.J.—October 14-15.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION, Annual Meeting, White Sulphur Springs, W. Va.—October 14-16.

AMERICAN STANDARDS ASSOCIATION,—30th Annual Meeting, Waldorf-Astoria Hotel, New York—October 20-22.

NON-FERROUS FOUNDERS' SOCIETY, Annual Meeting, Philadelphia—October 22.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, Metals Division, Annual Meeting, Philadelphia—October 25-28.

AMERICAN SOCIETY FOR METALS, 30th Annual National Metal Congress and Exposition, Convention Hall, Philadelphia—October 25-29.

SOCIETY FOR NONDESTRUCTIVE TESTING, Annual Convention, Philadelphia—October 27-28.

METALS CASTING CONFERENCE, Purdue University, Lafayette, Indiana—November 4-5.

MEEHANITE CASTING MANUFACTURERS, Annual Meeting, Pittsburgh—November 11-13.

American Foundrymen's Society, 53rd Annual Foundry Congress, St. Louis—May 2-5, 1949.

DESCRIBES ELECTRIC FURNACE MALLEABLIZING OPERATIONS

H. R. Cowles
Assistant Annealing Foreman
Lake City Malleable Inc.
Ashtabula, Ohio

SINCE THEIR INSTALLATION in the spring of 1944, the electric annealing furnaces at the Ashtabula plant of the Lake City Malleable, Inc., have produced many thousands of tons of high grade annealed castings and have proved to be practical and dependable in every way. The six pairs of 16-ton furnaces and one pair of 4-ton furnaces have a capacity of 2000 or more tons of malleable castings per month.

The 16-ton furnaces are the largest of the elevator batch type, and are of special interest because of their large capacity, ease of charging and control, and the uniform quality of the malleable product.

Build Furnaces in Pairs

These periodic electric elevator type annealing furnaces are built in pairs as shown in Fig. 1. Castings to be annealed are loaded on the car and raised into the high-temperature furnace. Upon completion of the high-temperature treatment the car is transferred to the low-temperature furnace where faster cooling can be achieved by means of air cooling tubes.

The overhead installation of the furnaces (Fig. 2) leaves the floor space open and airy, easy to clean, and allows free movement of traffic under and between the furnaces. The use of sand, and other packing materials being unnecessary, the loading and unloading areas are easy to keep shipshape. Dirt, smoke, and fumes are eliminated and the low heat dissipation of the furnaces makes working conditions unusually good in this annealing department.

The compactness of the annealing section, considering its great tonnage capacity, is remarkable. There are no bottlenecks, and with the short annealing cycles made possible by these furnaces plus the fewer man hours per ton required to load and unload the annealing cars, castings flow smoothly and quickly from Hard Iron to Finishing Department.

Low thermal lag in preheating and in forced cooling coupled with the uniformity of temperature in all sections of the charge make these furnaces especially suitable for arrested anneal or pearlitic work. The growing popularity of this product opens a new field for the foundryman who can produce it economically and to exacting specifications. The ability to closely control the annealing temperatures and uniformity of every charge is reflected in the equable and high physical properties of both malleable and pearlitic castings from these furnaces. Rejections or re-anneal of castings due to inadequate anneal are practically nil.

The common procedure of cleaning castings in the hard iron stage for better inspection at that point can be safely practiced as there is little oxidation in these furnaces. The annealed castings are free of scale and have only a slight de-carburized rim—the average loss of carbon during anneal being around 15 points—thus soft iron cleaning can be reduced, resulting in closer dimensions, and better appearance of the casting.

A wide range in design and weight of castings can be successfully annealed in these furnaces (Fig. 3). Castings in this plant run from ½ lb to over 300 lb in weight with an average weight of around 8 lb. Section size is usually between ½ to 2½ in. Most castings can be packed into annealing baskets. These baskets are flat bottomed, about 30 in. in diameter by 24 in. deep with small grill-work openings in sides and bottom. Their average capacity is about 1000 lb.

Large castings or castings of such design as to prohibit packing in baskets are stacked directly on the annealing car in such a manner as to prevent distortion. The annealing cars hold two tiers of 16 baskets

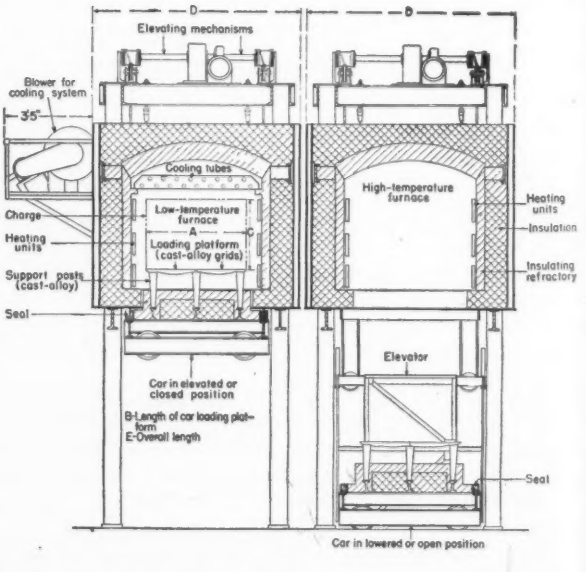


Fig. 1—Two-chamber electric annealing furnace.

A recent AMERICAN FOUNDRYMAN article describing and illustrating all types of malleable iron annealing equipment is "Annealing Malleable Iron" by R. P. Schauss (pp. 34-38, March, 1948).

each with individual basket grids between the top and bottom tiers. The usual procedure with mixed loads (Fig. 4) in this plant is to load the car with the lower tier of 16 baskets and cover with the platform of grids. Two second tier baskets are loaded on each end of the car as a retaining wall, and the large castings stacked onto the grid platform between the retaining baskets.

The recommended total load of castings, baskets, and grids on the car is 43,000 lb. The baskets in use here weigh about 270 lb each and the grids about 120 lb each. With some designs of castings, it is difficult to pack more than 14 tons on the car, while with others, a car can easily be overloaded.

Loading and unloading labor costs per ton in the annealing department are low. Because no sand or other packing materials are used, small castings are quickly and easily packed into baskets and loaded on to the cars by an overhead traveling hoist. Containers of larger castings are raised to the car grid platform level by a fork lifting truck and the castings stacked on to the platform. Very heavy castings are loaded individually by the hoist.

At the unloading area (Fig. 5), the castings not in baskets are unloaded into metal buggies by an overhead hoist with a magnet. Baskets of castings are set

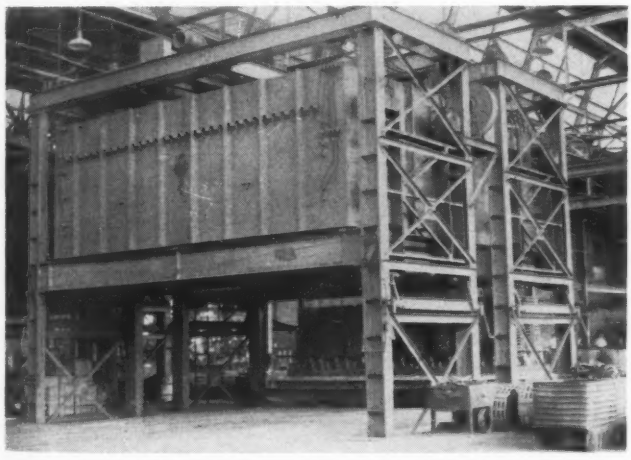


Fig. 2—High and low-temperature furnace bank. Cooling tubes through casing of low-temperature furnace carry air from blower mounted between the furnaces.

off the car on to roll conveyors feeding directly to the grinding machines where the baskets serve temporarily as grinding containers. Empty baskets are easily rolled back to the loading area by hand, or picked up and returned by the lifting truck. Labor time for loading and unloading of annealing cars, including all relative labor performed in the department by the loading crews, averages less than 1.0 man hours per ton and runs as low as 0.70 man hours.

Maintenance and repair on annealing cars and furnaces has been reasonably low. The costs over the past four years average about 15 cents per net ton of castings annealed. Annealing baskets and grids are of standard 35 per cent nickel-15 per cent chromium alloy. Practically all of the original baskets and grids are still in service. The life of the annealing baskets had been estimated at about 300 tons of castings per basket but generally most of them will greatly exceed that figure.

Fig. 3—A 32-basket load of hard iron in the loading area. Weight of castings on car is 29,500 lb including castings resting on the brickwork under the baskets.

With proper analysis control in the Melting Department, short annealing cycles are possible resulting in lower electrical power consumption per ton. The average here is approximately 375 Kwh per net ton for malleable, and from 10 to 20 per cent higher for pearlitic, depending on the type produced.

Peak demand kilowatt costs can be kept down by charging the furnaces when plant loads are lowest, and by staggering charging times of two or more furnaces to eliminate high peak demands while furnaces are coming up to temperature. A demand control device installed in this plant is of considerable help in holding down peak kilowatt demands during daytime loads. This instrument can be set to automatically cut off the power to the annealing furnaces at any predetermined maximum kilowatt demand at 15 minute intervals.

Avoids Peak Loads

The device resets automatically and throws the power back on to the furnaces at the end of the 15 minute period. As the peak demands at this plant are registered every hour by the power company's metering, the 15 minute interval limit of our instrument gives close control of furnace loads.

The annealing furnaces operate at a power factor of unity and as they consume the major portion of the electrical power used here, this greatly improves the over-all average power factor of the plant. Many power companies allow a credit to the consumer, in proportion, if power factor is high.

A 40 x 60 ft annealing control room (Fig. 6) is located above the transformer room in the center of the plant near the loading end of the annealing section. All instruments and auxiliary furnace control equipment are located here. This control room is operated 24 hours a day and seven days a week. One man is on duty each 8-hr shift and works six days a week. A relief operator handles maintenance on the annealing cars and furnaces, and relieves the regular operators on their days off. All maintenance in the control room is handled by the operators. Control room operating costs are approximately 50 cents per ton annealed.

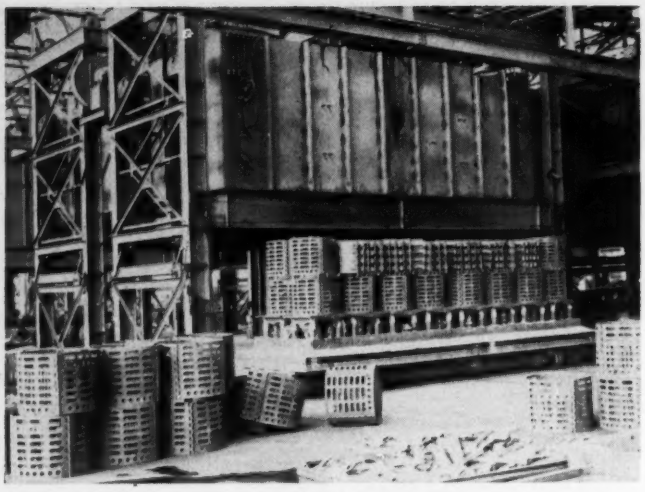


Fig. 4—Hard iron castings ready for annealing. Large castings are stacked on grid platform over baskets. Lightweight castings are on floor of the annealing car.

The 16-ton furnaces operate on 460 volt, 3 phase current. At full load, during preheat, a high-temperature furnace consumes about 820 kilowatts per hour. The rated amperage is 1030. The low-temperature, or cooling furnace is rated at 300 Kwh and 377 amp, but the low-temperature furnaces are rarely at full load except when used for pearlitic work. The average power consumption per charge is between 5,000 and 6,000 Kwh for the complete cycle.

Control Temperatures Automatically

Each pair of 16-ton furnaces is fed from a 13,800 v to 480 v, 1500 Kva, 1800 amp transformer through a 1600 amp main branch air breaker. An automatically controlled switch panel in the annealing control room contains all auxiliary switches, relays and protective devices. Furnace temperatures are controlled by automatic instruments. The heating elements in the furnaces are separated into sections, or zones, the high-temperature furnace having four zones and the low-temperature furnace three. Each zone has its own thermocouple, and its own indicating and control instrument. One of the four high-temperature furnace instruments is a two point recorder, recording the temperature of the zone it controls, and also, through a thermocouple in the car, the temperature of the charge. Any temperature from 500 to 2000 F can be maintained with a variation of less than five degrees.

The three zones of the low-temperature furnace can be controlled separately by their individual instruments or automatically by an "all zones" recording and control instrument. A separate thermocouple installed in the center of the roof of the low-temperature furnace is connected to this instrument and controls the over-all cooling rate of the charge, rather than the individual zones. The temperature of the charge in the low-temperature furnace is recorded separately.

A rate of cooling from zero to 25 degrees per hour is controlled by a circuit interrupter connected to a small motor in the "all zones" instrument. This motor drives the control pointer, at any predetermined rate of drop per hour. By reversing the motor leads, this same device will raise the furnace temperature at any given rate, and is very useful in pearlitic work.

An automatic blower system in the low-temperature furnace assures a positive rate of cooling. If the furnace temperature lags behind the predetermined rate of cool, the blower will boost it along as needed, or, if the furnace tends to cool too rapidly, the power will be turned on to the heating elements and the rate of drop checked. We have attempted to establish a rate of cool consistent to the normal dissipation of heat in the furnace throughout the lower critical range of the charge. By so doing, the furnace rarely calls for blower action and requires very little heat.

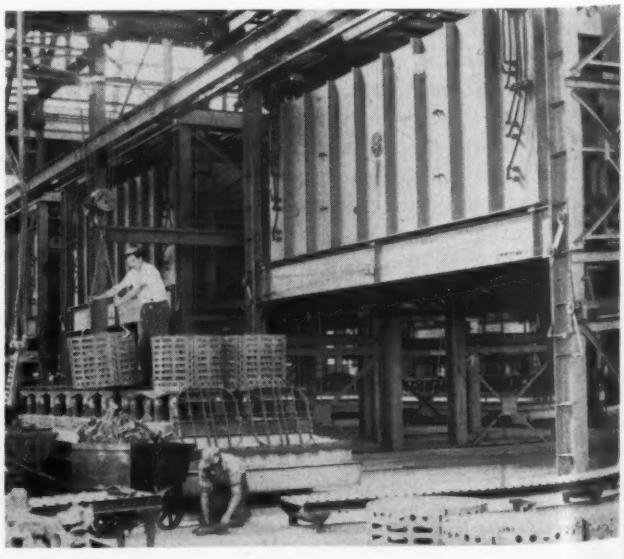
Our annealing cycles run somewhat less than 60 hours. With very close analysis control, and with light charging loads, extremely short cycles are possible, but as a standard procedure they would not be too practical. A high temperature furnace with a 16 ton load will preheat to holding temperature in 8 to 10 hours. During the transfer to the cooling furnace which requires about four minutes time, the loss of heat is 60 to 90 F as registered by the thermocouple at the center of the load. In the low-temperature furnace the charge is automatically cooled to the top range of the lower critical in about 6 to 8 hours, and then slowed to from 2 to 5 degree drop per hour.

When through the lower critical range, the charge is cooled by setting the blower controls on manual operation for about one hour before removing charge from furnace. During this forced cooling, no air is introduced into the furnace. The blower manifold is mounted along one side of the low-temperature furnace near the roof. Thirty-two 3 in. diameter tubes run from this manifold completely through the furnace casings and chamber to the opposite side. Cooling is accomplished by the forced air through the tubes dissipating the furnace temperature.

Accidental overheating of the furnaces is prevented by temperature limit fuses installed in each zone close to the thermocouple. These fuses have a melting point of 1900 F and when melted, will open the circuit.

At the start of a cycle, the controlling instruments of each furnace are pre-set for proper holding temper-

Fig. 5—Unloading annealed castings in unloading area. Castings are transferred to carts or moved to finishing department by basket on roll conveyor in foreground.



atures, rate of cool, etc., and further adjustment is usually unnecessary until completion of the cycle. The close control over all sections of the furnaces and elimination of variables during anneal is a big factor in producing castings with consistently high physicals.

Installation Is Compact

The six pairs of 16-ton furnaces, installed over three sets of tracks, cover a floor area 115 ft wide by 156 ft long, including the loading and unloading areas. Each pair consists of one high-temperature and one low-temperature, or cooling furnace, set 50 in. apart side by side allowing a quick and easy transfer of the annealing charge. Each pair takes a floor space of about 27 x 34 ft including the elevator pits under the ends of each furnace. These pits allow the car elevator to drop below the floor level to readily engage the annealing car and as a safety factor are fitted with covers over all sections not required for elevator travel. The over-all height from floor to top of the installation, including the upper framework and hoisting mechanism, is approximately 27 ft. Clearance from the floor to the lowest point of an annealing car raised completely into place in a furnace is 9 ft.

Two pairs of furnaces are installed over each set of tracks, with 34 ft spacing between each pair. The cooling furnaces are installed on the inside of this bank of four, allowing ample space for annealed charges to stand and cool, and yet allow free flow of traffic. Five annealing cars serve the two pairs of furnaces over each set of tracks. A car pulling chain is installed flush with the floor and runs from loading to unloading areas under the furnaces, between each set of tracks. The driving mechanism is under the floor at one end and is readily accessible. The mechanism is protected from damage by shear pins between the motor coupling and reduction gear.

The elevator hoisting mechanism is mounted on the supporting framework over each furnace and is driven by an electric motor through a gear reduction. The rate of lift is about 6 ft per minute. An automatic solenoid brake will hold a fully loaded car at any position of travel. Adjustable limit switches control the ultimate up and down travel of the elevator, and an inter-locked limit switch prevents the car pulling chain from being moved until the elevator is completely lowered on the down travel. When an annealing car is raised completely into the furnace, safety locking arms at both ends of the furnace are closed to prevent the elevator from lowering in case of a faulty brake.

Limit Switches Prevent Overload

Limit switches prevent the operation of the hoist circuit if an overload is encountered, thus preventing undue stress on the cables. Any slackening of the cables due to an obstruction of the elevator during down travel, will also open the hoist circuit and prevent damage.

Each furnace contains about 1100 cu ft of work space, the inside dimensions being approximately 23 ft long by 16 ft 10 in. wide and 6 ft 9 in. high. The sidewalls are insulated with 10½ in. of light weight insulating brick next to the casing and 4½ in. of 2600 degree insulating firebrick within the chamber. Roof insulation at center of arch is about 18 in. thick. The ribbon type heating elements are looped over porcelain hooks, or hangers on the sides and ends of the chamber. Thermocouples and fuses for each zone are inserted through the casing and brickwork from the outside with their tip ends flush with the heating elements. A vertical metal flange welded to the bottom plate completely around the furnace imbeds into a sandbox on the annealing car and forms a gas seal when the car is raised into place.

The annealing car is 26 ft 6 in. long by 8 ft 1½ in. wide with a height of 4 ft. 4¾ in. from floor to top of hearth. Its weight is about 15 tons, but in spite of its considerable weight the car moves very easily as each wheel rolls on two self-aligning ball bearings. A pulling dog on one side of the car is dropped to engage the floor chain when moving the car. The hearth plate or loading platform is 21 ft 10 in. x 5 ft 7 in., with a working area of 122 sq ft. The top level of the hearth is 16 in. above the brickwork of the car and carries the annealing charge well up into the heating chamber of the furnace. The hearth, its supporting posts, and all metal in contact with furnace heating chamber is of 35 per cent nickel-15 per cent chromium alloy.

Fig. 6—Partial view of furnace control room showing several automatic recording and control instruments.

The sand box, as mentioned above, extends around the entire outside edge of car, is 4¼ in. wide by 9¼ in. deep, and is filled with 50 mesh silica sand. Gas relief ports with manually operated valves extend through the bottom of the car and are closed after the car is placed in the furnace. They are effective for tests have shown that practically no oxygen exists after the first 4 or 5 hr of preheat. The remaining gases, being under slight pressure, prevent air from seeping in.

Light weight insulating brick and firebrick 14½ in. thick insulate the car bottom from the furnace heating chamber. The car thermocouple, which registers the temperature of the charge is inserted from beneath the center of the car, extending up through the brickwork and above the hearth, and is easily accessible when the car is in the furnace.

In summarizing, we feel that periodic electric elevator type anealing furnaces have provided:

1. Consistent high quality of the finished product.
2. Savings in time to both company and customer.
3. Flexibility of equipment as to pearlitic work, etc.
4. Production costs comparing favorably with other annealing procedures.
5. Low maintenance and upkeep costs.
6. Improved working conditions for employees.

Questions and Answers — THE ROUND TABLE

Sand for Casting Light Metal Alloys

We should appreciate some advice on the use of sand mixtures containing di-ethylene glycol, bentonite, and water for casting aluminum and magnesium alloys.

Di-ethylene glycol has been used in a number of foundry sands as a substitute for part of the temper water to prevent too rapid drying out of the sand. It is particularly effective in open sands such as are used for casting magnesium alloys but hardly seems necessary in an aluminum sand. Synthetic sands, of the type commonly made from a clean silica sand and bentonite or other mineral binder, are not commonly used in aluminum foundries. Choice of a natural sand will depend on the castings to be made. A sand with a green compressive strength of 5 to 8 psi, and a permeability of 5 to 30 is generally satisfactory.

Use of di-ethylene glycol or some similar liquid is necessary in the high permeability sands used for magnesium. About one per cent is commonly used. A protective agent is also necessary to prevent a reaction between water vapor and hot magnesium alloy. Varying from 3 to 6 per cent by weight, depending on the sand and the section size of the casting, the protective agent may be sulphur and boric acid, with or without fluorine compounds.

Natural sands or synthetic sands made from washed silica sand or from bank sand, bonded with 3 to 4 per cent bentonite, are used in magnesium foundries.

Burned-on Sand Causes Trouble

We are continually running into the problem of burned-on sand in inaccessible passages. This is not completely cleaned out, evidently, in our own iron foundry and in the steel foundries of our suppliers. On occasion it is very serious for this foreign matter to come loose during test or operation. For instance, in steam turbine manufacture, if the steam chest and the turbine casing castings contain this sand, it is apt to go through the turbine and ruin the blades and rotor. We have been considering various ways to get rid of the sand and would like your advice.

The difficulties you are encountering trouble every foundryman and manufacturer from time to time. Many castings are sprayed with paint in relatively inaccessible passages to bond the sand particles and prevent them from entering parts of the equipment where they will do damage. Such a method would not be satisfactory in high temperature steam chests and turbines, however.

Much of the sand probably can be loosened by acid pickling. Pickling solutions generally run in concentration from two to 15 per cent, and may contain sulphuric acid with an inhibitor or hydrofluoric acid without an inhibitor. To speed the pickling operation the solutions are often heated to temperatures of 140 to 180 F. Details of concentration, temperature, and inhibitors can be obtained from acid manufacturers.

A successful experiment in removing fused sand and oxides from steel steam turbine castings is described in John A Wettergreen's "Electrochemical Cleaning of a Large Steel Casting—an Experiment," AMERICAN FOUNDRYMAN, vol. 13, no. 4, April 1948, pages 120-124.

Wants Brake Shoe Composition

Our company uses a type of casting that is in service much like a brake on a car wheel. We are wondering whether there is a standard analysis for railroad brake shoes and to what extent this analysis would have to be modified to get the same microstructure in castings about 3/8 in. thick.

We do not know that there is a standard analysis for brake shoes, which for the most part are made of chilled iron. A likely composition would be: C 3.50-3.65%, approximately 1% Si, Mn. 0.50-0.60%, P less than 0.30%, and S under 0.12%. The silicon content, particularly, will govern the depth of chill.

There are several types of brake shoes, some with inserts of expanded steel somewhat similar to expanded metal lath. The insert is placed in the mold and becomes part of the brake shoe although it does not actually fuse with the cast iron. Other forms of inserts also have been used.

Inserts increase the chilling tendency, so if you use them you will probably want to experiment to determine the amount of silicon which will produce the microstructure you wish to obtain.

Substitutes Steel Clippings for Rails

We operate a small gray iron foundry and, until they became extremely hard to get, we used five to 10 per cent steel rails in the cupola charge. We can get steel clippings from a local tank shop, the material coming in pieces of various size and about 3/32 to 1/4 in. thick. What is your opinion on the use of these clippings?

You should be able to use the steel clippings successfully in your cupola. The thicker the material is the lower will be your oxidation loss. It is important, too, that the clippings be clean and not heavily covered with rust. We suggest you charge the clippings directly onto the coke, taking care to avoid packing the material and thereby increasing the resistance of the charge

to the blast. Very large pieces should be cut prior to charging to avoid channelling of the blast or deflection against the lining in case a piece falls into a horizontal position. It is well to start with a small amount of clippings, gradually increasing the percentage while studying their behavior in your cupola.

Die Castings Blister at High Temperature

We use aluminum alloy die castings at temperatures up to 1000 F. Between 900 and 1000 F surface blistering occurs. What causes the blistering? One of the causes given to us by the supplier is the presence of voids or porosity in the casting. Are voids inherent in die castings as such or does the alloy cause this condition, or does the shape of the casting have any effect?

Is there an aluminum die casting alloy which will not melt under 1200 F?

What can be done to aluminum die castings to enable them to withstand heat and blistering to 1200 F?

The surface blistering which occurs between 900 and 1000 F is quite probably due to the presence of voids or gas porosity in the castings. This is quite a common defect in aluminum die castings and we don't know of anyone who can produce die castings without this condition occurring.

The appearance of these blisters between 900 and 1000 F is not related to the melting point of the alloy, but is due to the fact that this temperature covers the eutectic melting or heat treating range of aluminum alloys. Selecting an alloy with a higher melting point would not solve the problem.

The use of very high injection pressures has done a great deal to eliminate the entrapment of gas in aluminum die castings. Recent claims have been made that a new method of die casting, called pre-fill die casting, eliminates gas entrapment.

Wants to Add Sea Coal to Heap Sand

We produce small machine castings and have very long runs. In order to secure a cleaner casting and to cut our cleaning time we are considering adding sea coal to the entire heap of sand on each molding floor.

It is uneconomical to add sea coal to the entire heap and in addition this is not necessary since sea coal will eventually be distributed throughout the sand if the plan outlined below is followed. If you intend to use sea coal, prepare a facing sand containing, at the start, about 5 per cent by volume of sea coal. Aside from the sea coal, the facing sand will be essentially the same as the heap sand, although some foundrymen like to add a small amount of finer sand or sand with a higher clay content.

The facing sand should be thoroughly mixed, preferably mechanically, and aerated before use. Apply it to the pattern to a depth of, say, ¼ in. by riddling through a fine riddle. If you have a sand system, put the facing through a fine screen before it enters the distribution system.

A few trials will indicate the correct fineness and amount of sea coal to use for the various castings you make. After the sea coal facing has been in use for a while, the heap sand will contain a certain amount of coal. Most foundrymen like to control the amount of sea coal in the heap sand as well as in the facing and generally use an ordinary carbon combustion train to measure the amount of seacoal. Since the method measures *all* the carbonaceous material in the sample it is not strictly accurate.

Who Should Gate Patterns?

We are buying from one gray iron source at least one million dollars worth of castings per year and the question of who should pay for the gating of match plates and for similar work has come up. The foundry insists on doing the gating and contends that it requires about 175 man-hours per month.

Our feeling is that this small amount should be included in their price to us for castings.

As far as we know, there is no established practice as to whether the vendor or the casting purchaser should absorb the cost of gating patterns. In general, it appears advantageous to permit the foundry to gate the patterns in the manner they deem best to produce satisfactory castings with the equipment, personnel, and foundry technique available.

For possible additional information on the matter of who should pay the charges involved, we suggest you consult one of the trade associations which will have information not in the field covered by American Foundrymen's Society which is a technical organization. Write to National Founders Association, 120 S. LaSalle St., Chicago 3, or to Gray Iron Founders' Society, 1010 Public Square Building, Cleveland.

Batteries Cooled During Charging

A UNIQUE SYSTEM for cooling storage batteries while on accelerated charge has been developed by engineers of the Reynolds Alloy Co., Listerhill, Ala. Faced with an industrial truck availability problem presented by round-the-clock foundry operations, the engineers devised charging racks to cool batteries for faster charging. The system has proved so satisfactory in its operation that three shifts of trucks can now operate on only two sets of batteries. Besides eliminating the need for a third set of batteries, this system prolongs the life of the battery by preventing excessive temperatures during accelerated charging.

The charging racks are constructed in the form of long concrete pits, with individual spray pipes containing cool well water installed under each charging

position. Batteries taken directly from trucks are placed over the pits for recharge and receive the immediate cooling effects of the spray.

ANALYZING MALLEABLE IRON

A Rapid Method for Cr, Si, and Mn Determinations

W. B. Sobers
Chief Chemist
Chain Belt Co.
Milwaukee

IT IS A WELL KNOWN FACT that a thorough and continuous metallurgical control is needed to produce a high grade malleable iron. For this reason a closer control of residual alloys is more essential than that normally required for wrought steels, cast steels, and cast irons. Among the tramp elements chromium is likely to be the worst offender, because amounts of approximately 0.10 per cent or more tend to retard graphitization under normal malleableizing operations. The resulting iron, because of retained carbides, is low in ductility and has poor machinability.

Owing to the larger amounts of steel scrap required in cupola and duplex melting of malleable irons, a higher residual chromium content can be expected in the molten metal than is normally obtained in batch or direct melting by the air furnace.

For metallurgical reasons it is obvious that the chromium content of the molten metal should be known previous to casting, so that ill effects of abnormal chromium contents may be mitigated by proper alloying in the furnace or ladles, or by modifying the annealing cycle, or a combination of both.

Combined Method of Analysis

By using the combined method of chemical analysis it is possible to determine chromium, silicon and manganese by a convenient and rapid method. This method is herein described and advantages discussed.

Because adequate control of the chemical composition is a necessity, the residual chromium content is determined from the silicon determination on the preliminary test by applying the combined form of analysis. The time required for the determination of silicon, manganese and chromium is from 20 to 25 min, depending on the speed of the operator and working techniques. The author has found this method to be practical and satisfactory for his operations.

Method Outlined

Weigh a 1.0-gram sample into a 150-ml beaker. Add 15 ml of dissolving solution. Set on hot plate and after sample is practically all in solution cover beaker with watch glass and evaporate to just short of dryness (do not bake). At this point add 3 or 4 ml of perchloric acid (70-72 per cent) from a burette (the 3 or 4 ml of perchloric acid is added to break up the carbides due to the high combined carbon content of the hard iron). Continue boiling until salts start to separate out for the second time (do not bake), or to the point where the salts will immediately solidify on removing beaker from hot plate.

Add 1 ml of perchloric acid from a burette, and approximately 30 ml of water. Boil for a few seconds until soluble salts have dissolved. Dilute to approximately 60 ml. Filter from beaker *A* (Fig. 2) into vacuum flask *B*. Wash the beaker out with two small washings of hot water (do not scrub beaker free of silicic acid at this point). Wash filter paper (7 cm) with hot water; total volume now is less than 100 ml.

Silicon Determination: Transfer funnel and filter paper from flask *B* to flask *C*. Scrub beaker free of silicic acid and wash onto paper through which original

Fig. 1—Nessler tubes used for visual colorimetric determination. Spectrophotometer is shown at right center.

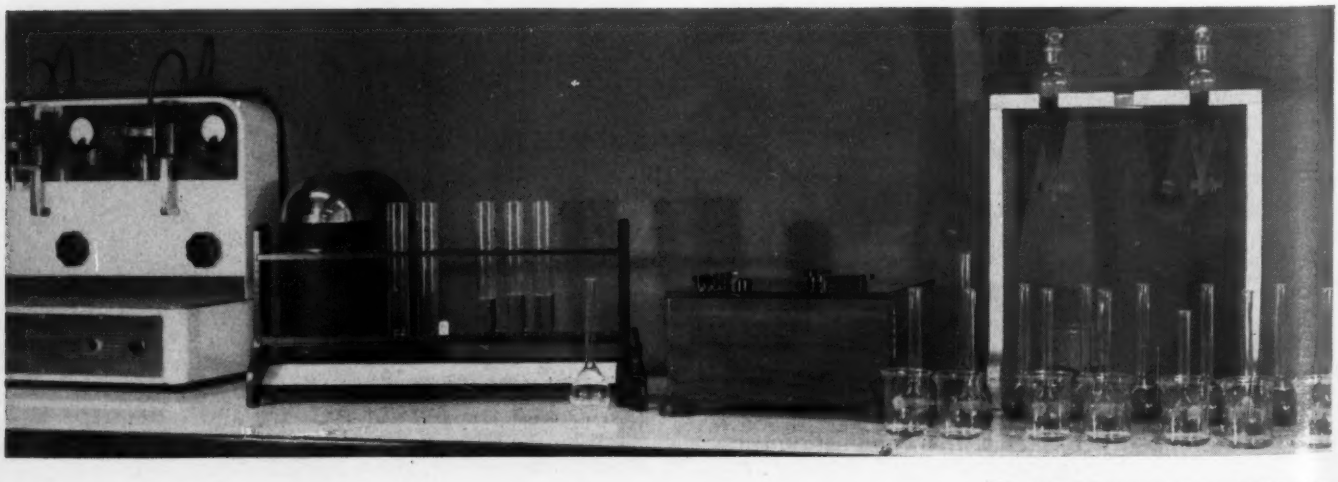


Fig. 2—Glassware used in method outlined. Left—Rotary filter table with water-flushing base for used filtrates.

solution was filtered. Wash the residue on the paper three or four times with hot HCl (1-10), followed by four or five washings with hot water. Ignite in a platinum crucible and weigh as SiO_2.

Manganese Determination: Transfer original filtrate from *B* into a 100-ml volumetric flask *D*, dilute to mark and mix. Call this the "master solution" (1 ml = 0.0100 gram or 10 milligrams). Pipette out 20 ml of master solution from *D* into a 250-ml Erlenmeyer flask *E* which contains a boiling solution of 10 ml of silver nitrate solution and approximately 60 ml of water. Add 15 ml of 10 per cent solution of ammonium persulphate. Heat until solution effervesces, adjust volume to approximately 100 ml, cool to tap water temperature and titrate with standard sodium arsenite solution.

Chromium Determination: Cool the remaining 80 ml of master solution in volumetric flask *D* to *room temperature*. Transfer approximately 40 ml of this oxidized chromium solution to a Nessler tube *F* (Fig. 1). Add two drops of reducing solution to the remaining 40 ml in volumetric flask *D* and transfer this reduced solution to another Nessler tube *F*. Compare visually by direct color comparison against suitable standards under like conditions for semi-quantitative percentage of chromium. If desired, the solutions may be checked quantitatively with a spectrophotometer or colorimeter, as shown to the right of the Nessler tubes in Fig. 1. Use the reduced chromium solution in place of water in the reference cell. Compare at 455 μ.

Other Elements: Quantitative colorimetric determinations for copper, nickel, molybdenum and phosphorous can also be obtained from the master solution by pipetting aliquot parts for the determinations involved. This method offers a rapid and economical means to conserve alloying elements by checking heats for residual alloys previous to adding additional alloys, or for checking heats for residual alloys that may affect the final product. It is obvious that this method may be applied in conjunction with melting operations for various types of ferrous metals.

TABLE 1—COMPARATIVE CHROMIUM DETERMINATIONS

Sample No.	Perchloric Acid Oxidation	Lab. No. 1—Ammonium Persulphate Oxidation	Lab. No. 2—Ammonium Persulphate Oxidation
1	0.048	0.040	0.051
2	0.096	0.096	0.105
3	0.192	0.198	0.200

Accuracy of Method: In order to check the perchloric acid oxidation method against the ammonium persulphate oxidation method, white cast iron samples containing approximately 0.05, 0.10 and 0.20 per cent of chromium were cast in the foundry. The samples were submitted in the hard iron state to two commercial laboratories for check analysis. The results are outlined in Table 1.

As shown in Table 1, chromium contents determined by the method outlined in this paper check closely with

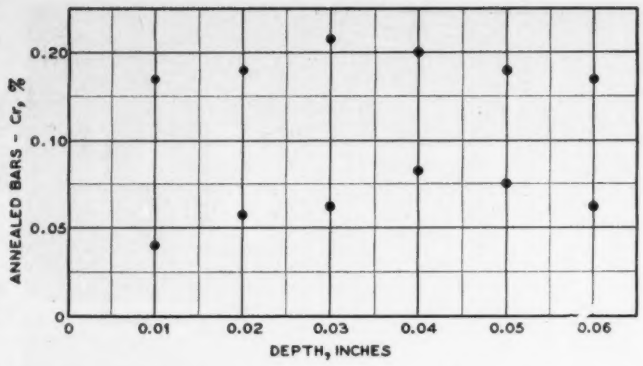


Fig. 3—Graph showing effect of normal annealing cycle on amount and distribution of chromium in standard tensile bars from Groups 1 and 3 containing from 0.05 to 0.20 per cent chromium in the hard iron state.

those determined by two commercial laboratories using the ammonium persulphate oxidation method.

Effects of Heat Treatment and Decarburization on the Analysis and Distribution of Chromium in Malleable Iron: In many cases the annealed malleable iron is checked for chromium to learn if that element is responsible for poor physical properties. Therefore, it is desirable to know if the amount of chromium is decreased by malleableization and, further, to learn if there is a redistribution of chromium due to migration or decarburization during the normal annealing cycle (periodic oven—50 hr to 1600 F, 45 hr at 1600 F, 32 hr down to 1320 F, 24 hr from 1320 F to 1270 F, 8 hr to 1200 F; open oven to remove load).

To determine the chromium content and distribution, bars of malleable iron containing 0.05 and 0.20 per cent chromium as analyzed in the hard iron state were tested as follows: consecutive cuts of 0.010 in. were turned from annealed standard test bars having surface decarburization of 0.023 in. Samples of each cut were analyzed by the method outlined (Fig. 3).

As may be seen in the graph (Fig. 3), the annealing treatment has no effect either on the amount or distribution of chromium. Therefore, it may be assumed that the analysis for chromium is the same in the hard iron or in the malleableized state. The chromic acid color obtained by the perchloric acid oxidation method is not affected by the malleableizing treatment.

STANDARD SOLUTIONS

Dissolving Solutions

Water, ml	250
Nitric Acid, ml	250
Perchloric Acid, per cent	70-72

Reducing Solution (Cr)

Ferrous Ammonium Sulphate, g	3
Water, ml	14
Perchloric Acid, ml	1

Transfer solution to a suitable dropping bottle so that 20 drops will approximately equal 1.0 ml, or be equivalent to 0.2000 g of the salt (1 drop equals 0.0100 g). Make fresh solution each week.

Reference

1. W. B. Sobers, "A Combined Method of Chemical Analysis," AMERICAN FOUNDRYMAN, p. 45, Aug., 1945.

"Eye Dropper" Technique Employed To Sample Molten Steel At 2700 F

SAMPLING MOLTEN STEEL at 2700 F is now being done at the Schenectady (N.Y.) Works Laboratory of the General Electric Co. by means of an "eye dropper," made of heat resistant glass.

The tube is about the diameter of a lead pencil and 18 in. long, with a rubber bulb at one end. Liquid steel is drawn up into the tube by squeezing the rubber bulb, just as an eye dropper is used. The steel hardens into a smooth, homogeneous rod, the glass is cracked from it and the steel rod is then ready to be checked for composition.

Eye-dropper samples may be prepared for analysis within a few minutes, whereas older techniques require such laborious techniques as cutting a block from a hardened steel mass, machining it into a rod, and buffing it to a high polish.

Using the new technique, three men wearing gloves and goggles form a highly-coordinated testing team. In a sequence that must take no more than 60 seconds, the first man removes a sample from the heart of the furnace with a ladle attached to a 10 ft handle. A second worker skims away the slag forming on the surface, and the third man sucks up a sample with the eye dropper.

The sample is cut in two and fitted into sockets in a spectroscope. An electric spark jumps between the two halves, giving off a light whose wave lengths are measured to determine the analysis of the sample.

Growth-Resistant Iron Developed By Research Metallurgists At Battelle

GROWTH-RESISTANT cast iron for the production of non-warping, non-expanding stove and oven parts, which will last indefinitely despite repeated subjection to high temperatures, has been developed by research metallurgists of the Battelle Memorial Institute, Columbus, Ohio.

This iron, unlike ordinary iron, does not grow when repeatedly heated to high temperatures—a major problem of heating appliance manufacturers for years and the cause of warping and buckling of heating surfaces.

The new growth-resistant iron was developed at Battelle in research sponsored by the Jackson Iron and Steel Co., Jackson, Ohio, who will market the silvery pig iron necessary for its production. The casting is a high silicon iron, with minute amounts of copper and chromium added during casting to make it resistant to scaling at high temperatures. The silicon is the element which gives growth-resistance to the iron.

As explained by Battelle technologists, the material will be excellent for use in applications requiring temperatures up to 1700 F. Like other high-silicon irons, it is brittle at low temperatures, but this inherent brittleness is offset by the good properties at the high service temperatures for which the alloy is designed. The iron maintains satisfactory growth, scaling and impact properties up to 1700 F.

Possible uses for the material include castings for cook stoves, heating stoves, home furnaces, melting pots, gas or oil burners, heat treating containers of various types and a variety of industrial equipment.

ASBESTOS ADDITIONS IMPROVE NONFERROUS FOUNDRY SANDS

J. W. Horner, Jr.
Vice President
The Slack-Horner Brass Mfg. Co.
Denver, Colo.

A BRONZE CYLINDER CASTING, which had given considerable trouble, led to the first use of asbestos as an addition to the molding sand in this nonferrous foundry. At first used on an experimental basis, it proved to be so satisfactory that all sands in the author's foundry now contain about 10 per cent (by volume) of asbestos.

Asbestos-containing sands can be used with any standard handling (mixing) equipment. In this foundry a muller, a gyratory riddle, and a cutter machine for mixing and reconditioning the sand have been used, and no difficulty was experienced with any of the methods. The only thing that would cause inconvenience is the use of very fine riddles for facing sand. Some of the asbestos would cling to the screens in this case unless it would pass through in the vertical position. However, even in this extreme case, the smaller fibers do pass through, and the facing sand probably contains sufficient asbestos to provide the advantages. No difficulty has been experienced with riddles providing the screens are $\frac{1}{8}$ in. or coarser in mesh. For mixing, the gyratory riddle has $\frac{1}{2}$-in. mesh, and the reconditioned sand passes through without difficulty. Hand mixing can also be used by small shops and for cores.

The bronze cylinder casting (Fig. 1) presented many difficulties. Defective castings caused terrific loss both in the foundry and in the customer's machine shop. Casting after casting would be rejected because of scabs, blows, cracks and gassing. Probably 50 systems of gating and risering were used, with approximately the same percentage of rejects resulting in each case.

Dimensions of the casting were 14 in. in diameter with a $\frac{7}{16}$-in. wall, and on the inside were four heavy ribs, about one in. square in section, running the full 6-in. length of the casting and spaced 90 degrees apart. In between these ribs were four smaller ribs, about $\frac{1}{4} \times \frac{1}{2}$ in. in section, also running the full 6-in. length of the casting.

At first the trouble was with cracks at the joints of the heavy and light sections. This trouble was overcome by the use of chills about one and a half times the heavy section, rammed up against every heavy section (Figs. 2 and 3). The castings were machined on the outside, and radial slots or grooves were cut entirely through the cylinder from the outside to the ribs so that the casting became a series of thin rings, 14 in. in diameter, held together and spaced by the ribs.

Most of the trouble was due to shrinkage. After the machining, shrink cracks would appear on the rings. The appearance of the crack indicated that both the outside and inside of the cylinder chilled rapidly, but that the center of the section, without feeding, would open up in a large crack parallel to the circumference.

Asbestos was added to the sand in varying proportions, as high as 50 per cent by volume being used. The shrinkage disappeared completely when the castings were poured by a riser-fed system, and sound castings were also obtained with the use of a pressure gate

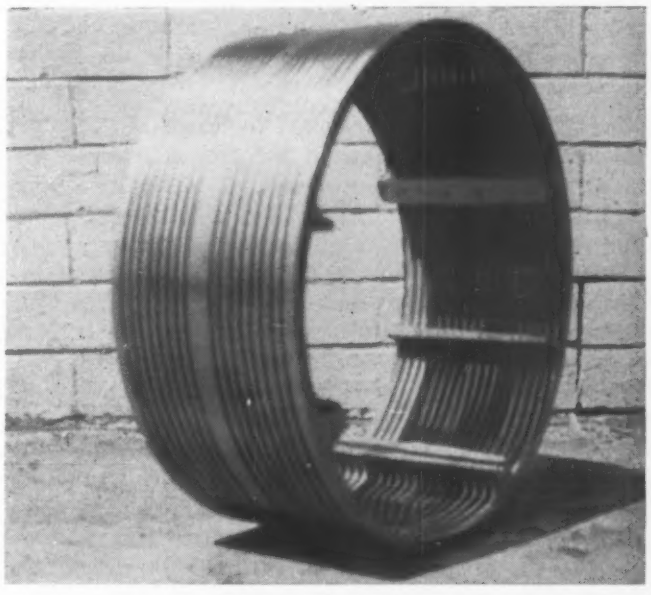


Fig. 1—A fully machined bronze (Navy M) cylinder casting. Slots are cut entirely through to the inside, the rings thus formed being held together by the ribs.

when the pressure was retained (Fig. 4). It was noted that the metal remained liquid in the open risers at least twice as long as in the usual sand mold. Of course, unforeseen difficulties were expected in the castings poured into the sand-asbestos mold, but the other advantages gained by the use of asbestos were even more surprising.

Less Scabbing and Burning-In

It was found that the tendency to scab or wash was practically eliminated. Even flat, wide areas, that often must be skin-dried, no longer "buckled" or scabbed in the "green" condition. This advantage probably was due to the fiber of the asbestos acting as reinforcement

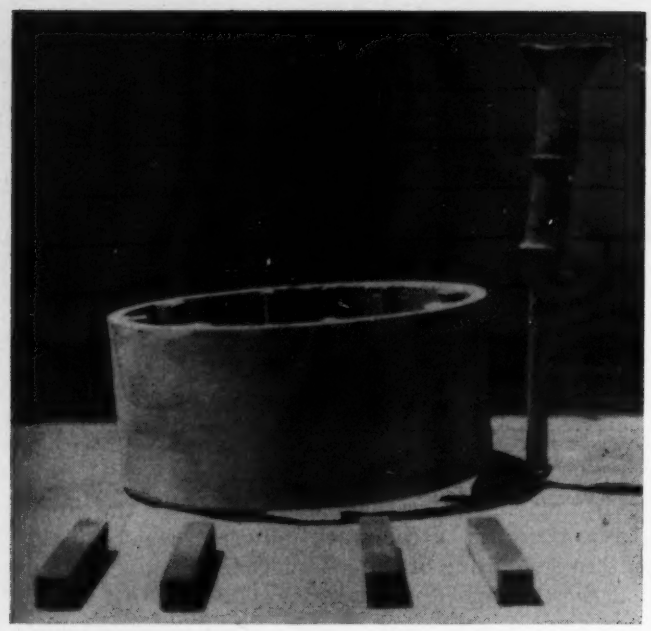


Fig. 2—With this gating method, shrink areas appeared after machining on the side opposite the pressure sprue. The cast iron chills used are shown in the foreground.

to the sand, in somewhat the same way as concrete is strengthened by steel rods. On one job alone requiring skin-drying, 10 hours of drying time was saved on molds for 20 castings.

Refractory Properties Increased

Another advantage noticed was the increase in refractory properties. Castings that hitherto would "burn-in" or search, no longer did so in the asbestos-sand molds.

Average asbestos content was about 10 per cent by volume, and even heavy castings cleaned up well. The elastic properties of the asbestos sand probably helped in that respect. There is more tendency for a natural bumping effect without cracking of a hard mold surface. The explanation may be that this "give" prevents metal penetration behind the mold surface.

It was an experience to see the way in which the asbestos was distributed on the mold surface. That distribution was remarkably even. Small white speckles clung to the surface of bronze castings like thousands of tiny dots, and were easily brushed off. These particles did not cling on aluminum castings, but the surface was even smoother than that produced with the aluminum sand mixture previously used.

Collapsibility Improved

Asbestos in the molding sand increases the collapsible properties. Asbestos fibers are soft and pliable, and they allow sands to contract without cracking.

Boxes or cylinders with thin sections are likely to crack upon solidification if the core which they surround does not give. This is especially true of aluminum alloys, as aluminum is brittle at high temperatures and the linear shrinkage considerable. Leakage in bronze valves and pressure vessels may also be attributed to lack of collapsibility. This subject also will be covered a little later, when cores are discussed.

We made the following tests on some of the sands for comparison of physical properties:

Local Sand (new, used only for a few days for aluminum work)

Permeability	15.7
Compressive strength, psi	4.5
Moisture, per cent	7.8
Average Fineness	143.7

Although good results are obtained when this sand is used for aluminum or for facing only in brasses, the sand has a low sintering point, and the strength breaks down and permeability decreases over a period of use for brasses and bronzes.

New Local Sand (Asbestos 10 per cent by volume)

Permeability	13.8
Compressive strength, psi	8.0 to 9.6
Moisture, per cent	7.8
Average Fineness	Same except added asbestos

This second test would seem to indicate that the permeability was lowered by the use of asbestos. However, it was not as low as that of a good Eastern sand that produced castings with an acceptable surface.

New Eastern Sand (considered a very good sand for medium size bronze castings)

Permeability	12.2
Compressive strength, psi	5.4
Moisture, per cent	8.4
Fineness	161.50
Clay, per cent	9.98

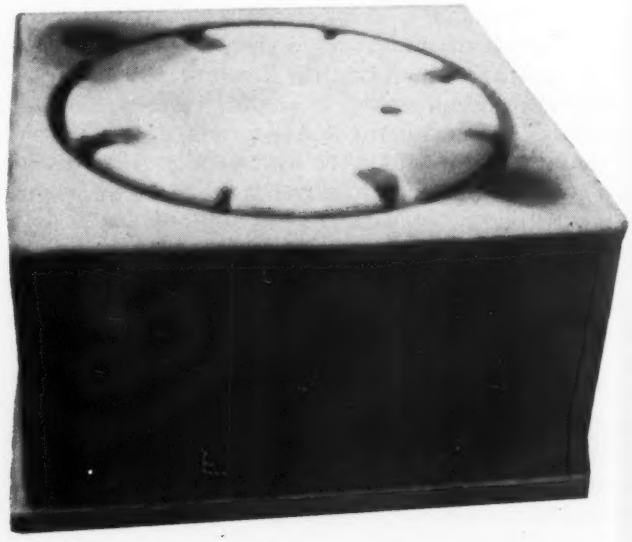
The Eastern sand has much better wearing qualities than local sand because it has a higher sintering point and probably does not have so much fine material.

To show the wearing qualities of the asbestos-local sand mix, a used sand was tested after a month of use.

Local Sand (10 per cent asbestos by volume, used very hard for 1 month)

Permeability	15.2
Compressive strength, psi	4.8
Moisture, per cent	7.6
Average Fineness	131.89
Clay, per cent	9.6

Fig. 3—Drag half of mold showing riser-sprues in relation to position of ribs. Black square sections in back of the large ribs are tops of the chills which are rammed up against the ribs in the pattern. These chill the metal in the large ribs and prevent cracks.



This last sand had had hard use with heavy castings, the heaps being used over and over about four times a day, 5 days a week. It will be noted that although the strength decreased somewhat, the other properties are in the desirable range. The lack of strength is probably due to the gradual removal of the asbestos from the heaps by adherence to the surface of the castings. Also, in this test there seemed to be an increase (about 20 per cent) in the grains on the 200-mesh screen. However, all other finer particles remained in about the same percentage. This shows a probable breakdown of the large sand grains due to a low sintering point, or perhaps particles picked up during hard use of the sand. However, there is no doubt but that the life of the sand was increased because of the asbestos. Previously, the shop had never been able to operate without constant daily additions of new sand in order to obtain even fair results from the sand heaps.

Properties of Local Sand

Local sand is a fine sand with considerable silt and fines—in general, a low grade all around sand for brass and bronze. Results of the tests indicate that the local plus asbestos is probably slightly superior in strength and permeability to No. 2 Albany sand, and the castings have a smoother surface. The casting surface is comparable to castings produced in about No. 0 Albany sand. It also seemed that the sand had good durability. Of course, new sand and asbestos were added at regular intervals, but no appreciable weakness was noticed even when the sand had a definite black burned-out appearance.

The local sand mentioned in this article has one great advantage in that it is low in cost. The desirable Eastern sands, while nominally priced, cost from $13 to $20 per ton after adding shipping charges to the Western part of the country. The local sand is not dependable in composition, and it breaks down with constant use. Although the structure of the sand grains has not been investigated, it might be suspected that the grains disintegrate with use and have a low sintering point. Nevertheless, the fact remains that this foundry has been able to obtain four times the previous life of the local sand by the addition of asbestos, and the casting results have been satisfactory.

Remarkable results were obtained by the addition of asbestos to core sands. At first, asbestos was added only to core sand for aluminum castings. About 30 per cent (by volume) of asbestos was used, and this was later reduced to about 20 per cent. The sand was a local silica sand (rather fine grained), with core oil as a binder. Satisfactory cores were obtained with a sand-oil ratio of 100:1.

The cores made were for aluminum gas burners, and had to be supported by unusually small core prints. The cores made in this way were sprayed with a molasses-water mixture in order to form a solid surface skin. The cores were lighter, did not blow in any case, and knocked out of the castings readily. The venting, also, was good. No special precaution was taken and, of course, due to the low oil content but little gas was created. The cores handled nicely after baking, and did not show warpage or weakness, even though they were delicate. The fact that the cores were completely surrounded by metal gave the best test for collapsibility, as the castings showed no leakage tendencies.

Asbestos additions to core sands for brass and bronze were tried with good results. It was possible to reduce the oil consumption one half and produce strong cores of better collapsibility, elasticity, and venting qualities.

Another advantage of asbestos in sand cores is that cores can be produced without minute cracks or fissures, thus preventing the metal from searching into them and forming rough fins. This elastic property should be an excellent preventative of burned-in cores. Valve cores having greater collapsibility would tend to promote pressure tightness in castings because of less structural strain.

As nearly as the author can determine, asbestos has been used in the foundry only during the past few years. Asbestos bottom boards and core-drying plates are gaining new users every day. The plates are manufactured of asbestos, bonded and produced under high pressure. The boards warp but little in use, and are excellent core-drying plates for that reason, as well as the fact that the low conductivity of heat keeps a core from burning or baking too fast against the drying plate, as is sometimes the case on metal dryers.

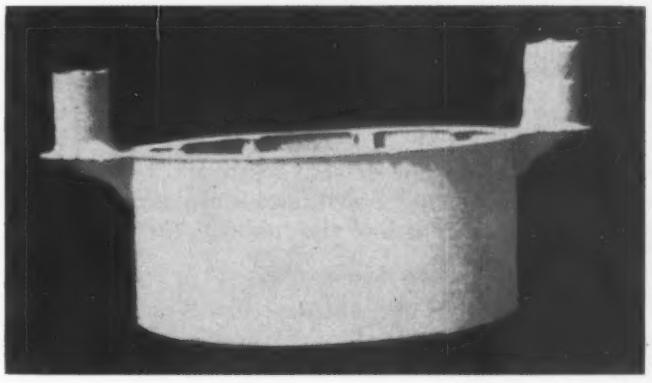


Fig. 4—Side view of a rough casting showing the riser-sprues used to feed the casting. Metal was poured two-up into these risers (in asbestos sand). This method is simple to make, and the losses were small.

The form of asbestos that the author found most practical for molding and core sand use is known as "asbestos shorts." The cost of this material is about $50.00 per ton at the mines. However, since asbestos is quite fluffy (resembling rock wool in appearance) there is a large volume in a ton of the material. For experimentation purposes the prices paid for small quantities ranged from $3.00 to $4.00 per 100-lb sack. A 100-lb sack of the material is sufficient to care for a 2000-lb sand pile.

Using Asbestos Paper

Asbestos paper has been used in various ways to protect cores and chills when "burning-in" tendencies are noticeable. Some heavy castings search or "burn into" the pores of the cores, and in such cases core removal is almost impossible, or many hours being required to knock out such cores. By wrapping the cores with asbestos paper, the burning-in can be eliminated.

A recent article, published in pamphlet form, described how asbestos paper was used to prevent the sticking of steel chills in a cast iron wheel. The foundry mentioned was having difficulty with a cast iron wheel which contracted around a wheel-axle chill. Although

the chill was tapered and coated with graphite, it was frozen and sometimes fused into the casting.

The problem was solved by splitting the chill longitudinally and inserting a piece of asbestos paper between the halves. The paper acted as a cushion and provided collapsibility when the casting closed around it. This little experience seemingly would indicate the value of asbestos in the construction of permanent cores for permanent molds.

It is also evident that asbestos paper could be used to advantage when very searching metals bite into the mold surfaces. Possibly the paper could be rammed-up with the pattern and pinned into place to actually form the mold wall.

Sometimes an expensive casting can be repaired by a foundry welding practice known as "burning on." In this method, the defective part of a casting is surrounded by molding sand and a small tube or sprue is taken to the defective area, a runoff basin being connected outside of the sprue. Metal then is poured into the sprue, melting the defective area and replacing it with new, clean metal which fuses into position, while the excess metal runs into the runoff basin.

Summary

The author does not wish to paint a picture of asbestos as a "cure-all" for foundry problems. Nevertheless, he believes that it can be very useful.

Although this article is based only on experience in a nonferrous foundry, the writer believes that, in some degree, the same advantage could be obtained in both steel and iron foundries. Where great collapsibility of cores is required, it is believed that asbestos would work well in iron or steel. If good insulation is required, an asbestos-rich sand should be advantageous around the heavy risers of steel castings.

NACE Takes Over Work Of American Corrosion Coordinating Committee

A PROPOSAL that the American Coordinating Committee on Corrosion transfer its activities to the National Association of Corrosion Engineers and thereafter cease to exist was adopted at the Committee's 10th Annual Meeting, St. Louis, April 6. Representatives of 16 participating technical societies, including Dr. J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., delegate from the American Foundrymen's Society, voted on the proposal.

The basis of the proposal is that the National Association of Corrosion Engineers is now sufficiently well organized to accomplish the fundamental purposes for which the ACCC was founded. In taking over from the ACCC, the NACE agreed to carry out such objectives as: maintaining the ACCC directory of corrosion workers; directing inquiries on corrosion problems to those most familiar with them; publishing abstracts of current literature on corrosion; preparing annual bibliographies of corrosion literature; maintaining files of corrosion abstracts; acting as correspondent for foreign technical societies; serving as a corrosion information clearing house for technical societies; and carrying out any unspecified objectives of the ACCC.

It was recommended that the NACE take over the assets of the ACCC and that no further contributions be required of ACCC member societies in the future.

Charles Edgar Hoyt Annual Lecture Available

GRAIN SIZE BEHAVIOR IN MAGNESIUM CASTING ALLOYS, the 1948 A.F.S. Charles Edgar Hoyt Annual Lecture is now available. An outstanding contribution to the metallurgical literature on magnesium casting alloys, the lecture was written by Charles E. Nelson, technical director of the Magnesium Division of The Dow Chemical Co., Midland, Mich., and presented at the Annual Business Meeting, 1948 Convention. The paper covers the subject of grain size comprehensively and is the result of considerable original work by the staff of the Dow laboratories and others. The paper has an extensive bibliography.

Members of A.F.S. may obtain a copy of this outstanding paper gratis on request by sending a postal card or letter to American Foundrymen's Society, 222 W. Adams St., Chicago 6, Ill. The price to non-members is $1.00, postpaid.

Downgrading of Copper-base Alloys

Some of the non-ferrous metals continue to be in short supply. This abstract of a talk given by William Romanoff, H. Kramer & Co., Chicago, at the 1948 Wisconsin Regional Foundry Conference, suggests substitute measures for brass and bronze foundrymen. Readers should also see "Ingot Metal vs. Virgin Metal" by Fred L. Wolf, pages 94-96, in the May issue.

DURING WORLD WAR II, virgin copper, tin and zinc were strategic metals, and very little, if any, were available for the manufacture of brass and bronze ingots or castings. Today copper and tin are not only scarce again for the above uses, but also high in price. It therefore becomes necessary again to downgrade some of the alloys so that castings can be made from ingots manufactured from available scrap.

Downgrading is not to be interpreted as cheapening the quality of the castings but merely reducing the amounts of the high priced elements such as copper and tin. In most cases the quality of the castings is as good, if not better, than castings made from material before downgrading.

In selecting an alloy, a consideration of the foundry practice of the alloy selected is essential. What good are physical properties, if good castings cannot be made both productively and at the right price?

Even if virgin metals were available, they would hardly be necessary for foundrymen have proved through the years that the results obtained on castings made from ingot metal are as good as those obtained from virgin metal. In addition, there is quite a saving in the cost of ingot as against virgin metals, as well as a fuel saving because ingot melts at a lower temperature than virgin copper. Also errors in weighing will not affect the analysis of castings made from ingot while analysis will be affected by errors in weighing of virgin copper, tin, lead, zinc, nickel, etc.

In many cases, the silicon bronzes, manganese bronzes and aluminum bronzes can be used as substitutes for the high tin bronzes, because they contain little, if any, of the scarce high cost element, tin.

WHO'S WHO

W. B. Sobers

Winfield B. Sobers, author of *"Analyzing Malleable Iron —A Rapid Method for Cr, Si and Mn Determination,"* Page 56, is metallurgical chemist for the Chain Belt Co., Milwaukee . . . Has held several executive research positions with foundries in Ohio, Pennsylvania and Wisconsin since starting as a laboratory assistant with Lycoming Motors in 1927 . . . Has developed several pieces of metallurgical laboratory equipment now marketed commercially . . . Mr. Sobers has written several articles for AMERICAN FOUNDRYMAN and A.F.S. TRANSACTIONS and has spoken before the 1944 A.F.A. Convention on the subject of iron and steel analysis.

C. A. Sanders

A strong advocate of the distribution of sand on five adjacent screens, as opposed to the more widely used three-screen sand, C. A. Sanders (*Foundry Sands Evaluated—Naturally Bonded vs. Synthetic,* Page 45) is known for his booklet, *Foundry Sand Practices,* and for his many appearances as technical speaker at A.F.A. chapter meetings . . . A graduate of Ohio State university, he collaborated with Wilbur Stout, Ohio state geologist, on the development of Ohio clays . . . He joined the American Colloid Co. in 1941, after working for the Lawrence Clay Co. . . . Commissioned in the Navy, he studied rocket warfare at California Institute of Technology . . . Later saw active service in both theaters.

H. R. Cowles

H. R. Cowles, author of *"Describes Electric Furnace Malleablizing Operations,"* Page 50, is annealing foreman at Lake City Malleable, Inc., Ashtabula, Ohio . . . Born in Geneva, Ohio, in 1906, he attended grade and high schools there . . . Went to work as an oiler with Cleveland's Hanna Steamship Lines then tried his hand as a landscape nurseryman in Perry and Painesville, Ohio . . . Operated his own electrical service business in Painesville from 1938 to 1941, when he joined the Diamond Magnesium Co., Painseville, as an instrument technician . . . Left there in 1944 to join Lake City Malleable. A member of the National Rifle Association, Mr. Cowles' other hobbies are horticulture, stamp collecting and photography.

J. W. Horner, Jr.

John W. Horner, Jr., author of *"Asbestos Additions Improve Non-Ferrous Foundry Sands,"* Page 59, is the scion of a long line of foundrymen . . . His father, grandfather, great-grandfather and great-great grandfather were founders . . . Mr. Horner attended both Colorado University and the Colorado School of Mines, holds a B.S. in Metallurgy . . . He is vice president and plant manager of the Slack-Horner Brass Mfg. Co., Denver, and secretary of the A.F.S. Timberline Chapter . . . He is a member of the Colorado Advisory Committee for Vocational Training of Molders and Coremakers—a project under way at Denver's Emily Grffith Opportunity Public School under the sponsorship of the Timberline Chapter.

C. C. Wright

Calvert C. Wright, co-author with W. J. Reagan of *"Anthracite-Coke Mixtures Used in High-Speed Cupola Melting,"* Page 37, is professor of Fuel Technology at Pennsylvania State College and chief of the Fuels Division there . . . English-born, Mr. Wright attended the University of Washington and received his B.S. in Chemical Engineering in 1927 and his Ph.D. there in 1931 . . . As research assistant at Washington, he was awarded a fellowship at Penn State by the National Research Council (1933-35) . . . Joined the college staff in 1935 and was appointed associate professor in 1937 . . . Has written for many technical publications and has spoken before several technical societies on cupola research.

W. J. Reagan

William J. Reagan, co-author of *"Anthracite-Coke Mixtures Used in High-Speed Cupola Melting,"* Page 37, is associate professor of Metallurgy at Pennsylvania State College . . . A graduate of Carnegie Institute of Technology, he has served with several steel companies in various metallurgical supervisory capacities . . . Mr. Reagan has spoken before many technical groups and has authored several papers on the making and chemistry of steel and slag control . . . He is past chairman of the AIME Electric Furnace Committee and a past member of the National Open Hearth Committee.

BOOK REVIEW

Handbook of Industrial Radiology, by members of the Industrial Radiology Group of the Institute of Physics. Edited by J. A. Crowther. viii, 203 pp. Price $7.00 (21s). Published by Edward Arnold & Co., London, (1944); Longmans, Green and Co., Inc., 55 Fifth Ave., New York, N.Y., (1945).

This useful book for the beginner in non-destructive testing of metals techniques is the outgrowth of a series of lectures on industrial radiology before the Industrial Radiology Group. The lectures were so well received it was felt that they should be made available to a wider audience. Mr. Crowther undertook the work of editing them for publication in book form, in the "Handbook of Industrial Radiology."

Chapters deal with Industrial Radiology: Industrial X-Ray Plant, Quantitative Measurements in Industrial Radiology, The Response of Photographic Materials to X-rays, The Radiography of Heavy Metals and Light Metals, Gamma Radiography, Some Uncommon Applications of Industrial Radiography, and X-Ray Protection.

Letters to the Editor

The American Foundrymen's Society

As a member of long standing, we deplore the action of the American Foundrymen's Association in changing the name to American Foundrymen's Society. Long usage of the letters A.F.A. has engendered esteem, and almost affection, amongst foundrymen throughout the world. Its goodwill value stood remarkably high. Yet, in making the change, its members are only following an action taken by the British Foundrymen's Association some twenty-seven years ago. It can be assumed that perhaps in both countries there is a section of the population who imagine that an association is an employers' organization. On the other hand, many people connect "society" with trade union activities. There are amongst the employee organizations some dozens of "societies" two of which—the United Metal Founders and the Iron and Steel and Metal Dressers—are within our own industry. Then there are the Poetry Society, the affairs of which at the moment are not too rhythmic, and, of course, the Royal Society, Britain's most highly esteemed scientific body. Still, the British Medical Association commands the esteem of the world! Thus what's in a name?

The change took place on July 1. The old Association and the new Society has some 10,232 members on its roll, and so is the largest foundry technical organization in the world. The Chicago Chapter has over 800 members, and therefore still heads the list numerically in regional organizations, with London running second. There are today 39 of these Chapters, which last year held 250 meetings. The annual conventions attract an attendance of 13,000 people. On a population basis the Institute of British Foundrymen compares quite well with the American Foundrymen's Society. Both have problems in housing their annual gatherings, and both share an enlightened policy of placing their findings freely for world consumption.

The histories of the British Foundrymen's Association and the American Foundrymen's Association are in many ways parallel, and cooperation was effected initially. It was strengthened with the passage of time. Since, in 1921, Mr. Elliott presented the first exchange Paper to the Blackpool conference, there have been about 75 such exchanges. These have materially enriched the technical literature on both sides of the Atlantic. Under its present enlightened direction the A.F.S. enters a new era with the assurance of success and with the best wishes of all foundry associations.

V. C. FAULKNER, *Editor*
Foundry Trade Journal
London, England

Not a "letter to the editor," this editorial from the July 8 issue of the *Foundry Trade Journal* expresses one reaction to the name change which made A.F.A. the American Foundrymen's Society.

"Letters to the Editor" provides *American Foundryman* readers with an outlet for written comment on any subject of foundry or A.F.S. interest. Starting with this issue, the new magazine department enables foundrymen to carry on a public exchange of correspondence with one another and with A.F.S. Headquarters. The result should be similar to the interesting, instructive conversations held whenever two or more foundrymen get together. Shop talk, new ideas, old ideas, opinions, comments, and criticism are welcome. Write to: The Editor, *American Foundryman*, 222 W. Adams St., Chicago 6, Ill.

High Manganese Steel Melting

Please refer to page 59 of "The Round Table" in the July issue of the AMERICAN FOUNDRYMAN. We are very interested in the statement, "As a result of a good deal of prejudice from previous experience, and hearsay, we are limiting the percentage of return scrap in the charge to 10 per cent," which appears under the heading, "Scrap Pile Growing Too Large." We are not too sure that the portion of the answer which states that there appears to be no reason for restricting the percentage of manganese steel scrap if the finishing practice insures clean steel and proper analysis is correct. We are not denying—we are seeking information.

Our normal practice calls for a charge of 35 per cent austenitic manganese steel scrap, 57 per cent low carbon wrough scrap, and 8 per cent ferro-manganese. Using this charge we have experienced periodic as-cast cracking epidemics. In February of 1947, cracking of certain castings in the as-cast condition became critical and the manganese scrap charge was reduced to 25 per cent. There was no bona fide reason for supposing that this change would clear up our difficulties; however, it apparently did. Immediately after instituting the 25 per cent manganese scrap charge practice, an entire series of test heats was made utilizing the old 35 per cent return practice. Identical castings were poured on these heats and susceptibility of cracking versus the following foundry variables was checked; hot pour, cold pour, hot shakeout, cold shakeout, shakeout vibrating time, and sand strength.

These tests failed to produce cracked castings. It might be assumed from the above that these factors could not have been responsible for our cracking sieges; however, since 35 per cent returns were used in the tests it might also be assumed that the practice of using a higher proportion of scrap could not be at fault.

Since completion of the above tests we have experienced additional as-cast cracking epidemics and each has been halted apparently by reducing the percentage of return scrap in the charge. To date we have not been able to correlate any differences in microstructure, chemical analysis, or metal cleanliness with the crack-

ing difficulties. All heats, whether cracked or sound, exhibit similar physical properties when quenched.

A recent test consisted of production of four heats as follows:

A—60 per cent manganese return scrap in charge; normal furnace practice. Cracks were encountered.

B—60 per cent manganese return scrap; melting was rushed and practically no reducing period used. No cracks were encountered.

C—15 per cent manganese return scrap; normal furnace practice. No cracks were encountered.

D—60 per cent manganese return scrap; heavy reducing period. Cracks were encountered.

These four heats were analyzed by wet chemical methods, tramp elements were looked for by means of spectrographic analysis, microstructures were compared, x-ray diffraction structures were compared, and tensile properties were obtained without noting any correlation with cracked heats. The accompanying photograph illustrates the only correlation found. Note the rough surface of the test bars from the 60 per cent normal and 60 per cent reduced heats which produced cracked castings, and the smooth surface of the bars from the 60 per cent rush and 15 per cent normal heats which produced no cracked castings.

If any other foundries offer any of their experiences on this problem, we would appreciate it if they were passed on to us.

R. E. KERR, *Metallurgist*
Pettibone Mulliken Corp.
Chicago

Comments on high-manganese steel melting may be addressed to Mr. Kerr or to The Editor, *American Foundryman*.

Explains Converter Duplexing

In your issue of January, 1948, you publish an article under the title "An American Observes European Foundry Methods." The paragraph on British melting methods may give a wrong impression to your readers.

The term *converter duplexing* is used to describe the Tropenas converter process of steelmaking for the foundry, and may be confused with other processes, where an electric furnace is used as a holding or refining unit. Such processes, which should, more accurately, be described as *triplex* processes, have not found favor in the British steel foundry industry up to now. The Tropenas converter, on the other hand, is well-established as the best all-around method of steel melting for light steel castings up to, say, 75 lb in weight.

A particular reference is made to a 10-ton acid electric furnace operated at F. H. Lloyd & Co., Ltd. This firm actually operates a number of electric furnaces with capacities ranging up to 15 tons, and the Tropenas converter process. All the electric furnaces operate the two-slag basic process, with the exception of a 2½-ton furnace, which has been successfully operating with an acid lining for the last two years. Although not quite up to the standard of the two-slag basic electric steel, the metal produced in the latter has been entirely satisfactory for the purposes for which it has been used.

The scrap melted in this furnace has been principally returned foundry scrap—mostly basic electric melted—and therefore the very best which could possibly be put into a furnace. It would, however, be incorrect to suggest that satisfactory acid electric steel cannot be made from ordinary good quality steel melting scrap which is available on the British market.

F. N. LLOYD, *Managing Director*
F. H. Lloyd & Co. Ltd.
Wednesbury, England

Thank you.

Hadfield's Steel Not Magnetic

What's wrong with this sentence from "The Round Table," July issue of AMERICAN FOUNDRYMAN: "The heavy steel ball, frequently cast of austenitic manganese steel, may be lifted by a crane and electromagnet, or by a winch."

A. W. GREGG, *Executive Engineer*
Whiting Corp., Harvey, Ill.

Properly heat treated Hadfield's manganese steel is austenitic and not magnetic and could not be lifted with any type of magnet.

Casting Defects

In our regular furnace meetings we are starting a series of discussions on casting defects, using as a guide the A.F.S. book ANALYSIS OF CASTING DEFECTS which we recently purchased. We should like to reproduce the outline of causes of casting defects as given in this publication. A large chart is planned which can be hung on the wall for use during the meetings.

CARL KLAFFKE
General Manager
Furnace Foundry Co.

Permission to reproduce the castings defect chart is granted with the request that the reproduction include acknowledgement to A.F.S. and *Analysis of Casting Defects*.

FEF COMPLETES ITS FIRST YEAR

Six Point Youth Encouragement Program Well Under Way

COMPLETING THE FIRST YEAR of its three-year program, the industry-sponsored Foundry Educational Foundation is today well along in its six-point program to aid the nation's youth in obtaining the finest possible foundry engineering education at the college level, and in finding them profitable and permanent careers in the foundry industry.

Organized early in 1947 under the aegis of the American Foundrymen's Society, the Gray Iron Founders' Society, the Malleable Founders' Society and the Foundry Equipment Manufacturers' Association, the Foundation operates its three-year program on a $323,000 budget, subscribed by more than 400 foundries and foundry equipment manufacturers throughout the United States.

Objectives of Foundation

The six-fold purpose of the Foundation, as outlined in its articles of incorporation as a non-profit organization in the State of Ohio, is:

1. Aiding six geographically well-distributed colleges to develop and arrange basic courses of study to prepare young men for the foundry industry.
2. Assisting these colleges to procure required foundry equipment.
3. Establishing foundry industry scholarships at the six engineering colleges.
4. Encouraging promising young men to enter special courses of engineering in training for entrance into the foundry industry.
5. Establishing a headquarters under a competent executive secretary to carry on the work of the Foundry Educational Foundation in years to come.
6. Obtaining well-trained young men needed for service in foundries as potential leaders on the management and supervisory levels.

Six Engineering Schools Chosen

To carry out this plan, six nationally-known engineering schools, strategically located near centers of the foundry industry, were selected—Massachusetts Institute of Technology, Case Institute of Technology, Cornell University, Northwestern University, the University of Wisconsin and the University of Cincinnati. To cover scholarships and supplementary assistance, $87,250 has been distributed to the six schools.

In addition to the awarding of scholarships to foundry students, the Foundation during the last year has worked closely with the engineering faculties of the six schools and with the foundry industry in setting up curricula, preferably cooperative, in which the student augments his scholastic studies with actual foundry experience gained by working summers and, in the case of cooperative students, by alternating periods of study with work periods in the foundry. This is particularly emphasized during the student's third and fourth years.

While the first two years of the student's engineering course are generally spent in the classroom, under the Foundry Educational Foundation's recommended course of study, experience is provided in the third year by actual employment in the four main departments of nearby foundries—core making, molding, melting, and casting cleaning.

In the student's fourth year he receives in-plant training in maintenance and trouble shooting and is allowed a period for flexibility of assignment. In his final semester, the student is assigned to a special project paralleling foundry engineering. Whenever possible, the student is placed on the job in a foundry as an operator or helper.

Student Placement Service

One of the most important functions of the Foundation during the last year has been the placement of undergraduates in summer jobs and of graduates in positions with "career" foundries. This year, the Foundation placed some 70 undergraduates in summer foundry jobs and some 50 graduate engineers in permanent positions in all types of foundries throughout the United States.

Every effort is made by the Foundation, acting as a liaison between school and industry, to give the undergraduate a thorough grounding in foundry fundamentals during his summer employment. With regard to graduate students, the Foundation endeavors to place the young engineer with a foundry whose train- facilities will afford him a broad background and knowledge of foundry fundamentals before he is assigned a permanent niche in a definite phase of the metal castings industry.

Use A.F.S. Training Plan

Using the *"Foundry Training Course for College Graduates,"* developed by the A.F.S. Educational Division, as a basis for its program, the Foundation has set up a recommended in-plant training course for graduate engineers requiring 18 to 24 months to complete before the graduate is considered sufficiently grounded in foundry fundamentals to fill a position of small responsibility.

The Foundation's in-plant training program begins with an orientation period wherein the graduate meets foremen and executives and observes operations throughout the plant. Then an intensive period begins, during which the graduate's time is apportioned between the various foundry departments as follows:

Pattern Shop, five weeks; Molding Department, 15 weeks; Core Room, 10 weeks; Finishing Department, five weeks; Melting Department, 15 weeks; Laboratory and Testing Department, 15 weeks; and Cost and Estimating Departments, 15 weeks.

Upon completion of the 18-month training period, the graduate should be familiar with all phases of foundry operation, and should know definitely what department appeals to him most. He is then given six months of specialized training in that department, and assigned to a position there consistent with his abilities upon conclusion of the period.

Although the Foundry Educational Foundation is primarily concerned with foundry education at the

college level, the need for acquainting high school faculties and students with the opportunities that exist for young men in the foundry industry has long been recognized. This is particularly true in the case of those young men who for some reason cannot go on to college at the completion of their high schooling and must enter industry.

High School Conference

With this in mind, officials of the Foundation, headed by Executive Director George K. Dreher, arranged with the Northwestern University Technological Institute to invited high school teachers and students from all over the country on April 8 for a series of meetings designed to acquaint such personnel with the purposes of the Foundation.

Dean Ovid W. Eshbach of the Institute welcomed the teachers and students. This was followed by an address by Anthony Haswell, Foundation president, who spoke on the purposes of the Foundation. The group then toured the Institute's foundry facilities.

FEF President Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, Ohio; Northwestern Technological Institute Dean Ovid E. Eshbach; R. J. Redmond, Buckeye Foundry Co., Cincinnati; FEF Board Chairman Anthony Haswell, Dayton Malleable Iron Co., Dayton, Ohio; D. G. Anderson, National Founders Association, Chicago; Stowell C. Wasson, National Malleable & Steel Castings Co., Chicago; and W. G. Mixer, Buick Motor Division, GMC, Flint, Mich., examining Northwestern's foundry.

Professor Richard H. Cole, in charge of the Foundry department at Northwestern, explained how the Institute prepares the student for executive foundry positions. The Institute's foundry faculty, he said, has been carefully selected and instructed in teaching methods. In citing the courses recommended for the foundry student. Professor Cole emphasized the Institute's appreciation course, suitable for all engineering, which defines the techniques of foundry operation along with its benefits to the young engineer. Succeeding courses take up more specific studies of foundry operation, and will shortly include a special course in casting design.

Three presentations on the opportunities existing in the foundry industry began with "An Example of Foundry Engineering," given by William G. Mixer, general superintendent of the foundry of Buick Motor Division, General Motors Corp., who outlined all engineering operations required to build and operate the Buick Aircraft Foundry during the war. The second talk, by George K. Dreher, outlined the statistical needs for managerial talent within the industry and showed the ultimate load which universities must carry to satisfy the foundry industry.

Mr. Dreher stated that, since the foundry industry cannot absorb the entire load at one time, a gradual increase in the output of students is more desirable than a sudden flood of graduates. Statistically, he said, this would begin with a need for about 100 graduates in 1948 and would increase at the rate of 100 per year up to an annual total of 800 to 1000 graduates.

The third presentation was a film loaned by the National Engineering Co., "New Foundry Horizons," contrasting old foundry methods with today's trends.

Dean Eshbach concluded the meeting with a discussion of the operation of the Northwestern Technological Institute's "Co-Op" program, and its benefits in training engineers.

New officers and trustees of the Foundry Educational Foundation, elected in May during the A.F.S. Convention are: chairman of the board, Anthony Haswell, Dayton Malleable Iron Co.; president, Peter E. Rentschler, Hamilton Foundry & Machine Co.; vice-president, Richard W. Crannell, Lehigh Foundries, Inc.; secretary-treasurer, Charles A. Barnett, Foundry Equipment Co.; and executive director of the Foundation, George K. Dreher.

Trustees: Stowell C. Wasson, National Malleable & Steel Castings Co., and F. G. Sefing, International Nickel Co., representing the American Foundrymen's Society: John M. Price, Ferro Machine & Foundry, Inc., and Peter E. Rentschler, Hamilton Foundry & Machine Co., representing the Gray Iron Founders' Society; Bruce L. Simpson, National Engineering Co., and Charles A. Barnette, Foundry Equipment Co., representing the Foundry Equipment Manufacturers' Association; Anthony Haswell, Dayton Malleable Iron Co., and Richard W. Crannell, Lehigh Foundries, Inc., representing the Malleable Founders' Society.

Trustees at large: Jas. H. Smith, Central Foundry Division, General Motors Corp.; George F. Hutchins, II, Standard Foundry Co.; B. D. Claffey, Acme Aluminum Alloys; C. R. Culling, Carondelet Foundry Co.; Brinton Welser, Chain Belt Co.

It has recently been announced that the Non-Ferrous Founders' Society has been elected a founding member of the Foundry Educational Foundation and will be represented by Trustees W. B. Wilkins, American Manganese Bronze Co., Philadelphia; and G. B. Hazen, Brass Foundry Co., Peoria, Ill.

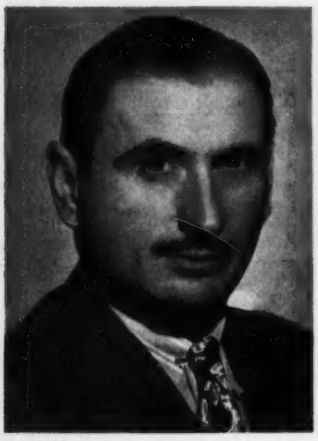
Chapter Officers AFS and Directors

A. W. Gregg
Whiting Corp.
Harvey, Ill.
Director
Chicago Chapter

H. L. Creps
Frank Foundries Corp.
Muncie, Ind.
Vice Chairman
Central Indiana Chapter

W. D. Dunn
Oberdorfer Foundries
Syracuse, N.Y.
Treasurer
Central New York Chapter

F. K. Brown
Adams, Rowe & Norman, Inc.
Birmingham, Ala.
Director
Birmingham Chapter



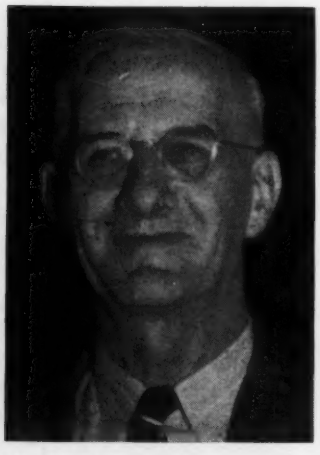
N. S. Covacevich
La Consolidada, S.A.
Mexico City, D.F.
Secretary
Mexico City Chapter

B. A. Genthe
S. Obermayer Co.
Cincinnati, Ohio
Secretary
Cincinnati District Chapter

Joseph W. Costello
American Hoist & Derrick Co.
Minneapolis, Minn.
Director
Twin City Chapter

C. S. Winter
Duplex Mfg. & Foundry Co.
Elyria, Ohio
Director
Northeastern Ohio Chapter

F. K. Donaldson
Machined Steel Casting Co
Alliance, Ohio
Director
Canton District Chapter



Frank W. Beierla
Clinton Pattern Works
Toledo, Ohio
Director
Toledo Chapter

D. W. Talbott
Cooper Alloy Foundry Co.
Hillside, N.J.
Director
Metropolitan Chapter

C. L. Lane
Florence Pipe Fdry. & Machine Co.
Florence, N.J.
Chairman
Philadelphia Chapter

START A. F. S. EMPLOYMENT SERVICE

Board Approves Placement Policy For Society Members

FROM TIME TO TIME, A.F.S. assistance has been requested by individual members seeking foundry employment, and by firm members seeking personnel. With the growth and spread of Society activities, it has become increasingly difficult to bring together the right men for the right jobs, through limited personal contacts and information.

Realizing that such service may rightfully be expected of a technical society by its membership, the Board of Directors has authorized the initiation of an A.F.S. Employment Service, effective with this issue of AMERICAN FOUNDRYMAN, to be made available only to A.F.S. members in good standing. Henceforth, these columns will be open to individual members seeking foundry employment, and to firm members seeking qualified personnel, under the terms below.

Positions Wanted

1. Items will be accepted *only* from individuals holding *their own* Personal Membership in A.F.S., in good standing.

2. Before submitting items, A.F.S. Applicant Registration Form must be obtained from A.F.S. Headquarters, and such form must be filed with Headquarters before item will be published.

3. No item will be published in more than three consecutive or separate issues of AMERICAN FOUNDRYMAN; applicant may select issues desired. A charge of $5.00 per item per issue will be made, invoiced on date of mailing to applicants in the United States, Canada, and Mexico. Outside U.S., Canada, and Mexico, payment must be made in advance in U. S. Currency.

4. Firms desiring to contact applicants should write A.F.S. Headquarters on firm letterhead, designating Item Number and issue. Copy of applicant's Registration Form then will be sent to firms and all negotiations thereafter must be carried on direct with applicant.

Help Wanted

1. Items will be accepted *only* from firms holding either Company or Sustaining Membership in A.F.S., in good standing.

2. Items must be submitted on firm letterhead, or accompanied by letter thereon, signed by a responsible official of the company.

3. No item will be published in more than three consecutive or separate issues of AMERICAN FOUNDRYMAN; firm may select issues desired. A charge of $10.00 per item per issue will be made, invoiced on date of mailing to firms in the United States, Canada, and Mexico. Outside U. S., Canada, and Mexico, payment must be made in advance in U. S. Currency.

4. Individuals desiring to contact firms seeking personnel through "Help Wanted" items should write the A.F.S. National Office, designating Item Number and issue in which published. A.F.S. Applicant Registration Form then will be sent to applicant for filling in and returning to A.F.S. Headquarters. The form will be sent by Headquarters to the firm whose name will be divulged at the same time. All negotiations thereafter must be made between applicant and firm.

General

1. All items under "Help Wanted" or "Positions Wanted" must be limited to 50 words or less. A.F.S. cannot prepare the items, but reserves the right to edit or abbreviate them consistent with technical publication standards.

2. A.F.S. Headquarters cannot under any circumstances recommend or vouch for individuals or for applicants' qualifications.

3. Items intended for any one issue of AMERICAN FOUNDRYMAN must be on file, in approved form, with A.F.S. Headquarters by the 24th of the month preceding date of publication. Publication date is the 15th of each month. Cancellations cannot be accepted later than the first of the month.

A.F.S. Employment Service

POSITIONS WANTED

PW100—Superintendent or Foreman: Any department, production, non-ferrous or gray iron foundry. Good references, 25 years experience in Chicago area. Will leave Chicago. Available immediately.

HELP WANTED

HW500—Metallurgist: Gray iron foundry located in Middle West specializing in high test medium and heavy weight castings requires services of experienced metallurgist. In reply, state age, education, experience, and salary desired.

HW501—Foundry Foreman: Assistant to foundry superintendent; good technical background essential. Gray iron experience preferred but will consider man over 30 with metallurgical education and related experience. Old established Pennsylvania engine manufacturer; 150-man foundry.

HW502—Foundry Superintendent: Superintendent for old established malleable foundry in Eastern territory. Experience in conveyor molding, gating, and feeding, essential. Knowledge of malleable metallurgy and duplex melting helpful. State experience and salary expected.

HW503—Foundry Foreman: By old established malleable foundry in Eastern territory. Experienced in bench or floor machine molding. Good opportunity for man who can control scrap and costs.

Predicts Labor Shortage

THE FOUNDRY INDUSTRY will be among those acutely affected by a manpower crisis within the year, according to a survey made by the United States Employment Service. The reasons for the shortage of labor are given as the rearmament program, a boom in business activity, and the revival of the draft.

It is estimated that the rearmament program will absorb 600,000 employees, including about 100,000 who will transfer from less essential jobs. The Armed Forces will levy about 400,000 men.

The armament program is expected to draw heavily on skilled foundry workers. Man power experts predict a shift of skilled workers in the metal trades industries from non-defense to defense industries. Much of this shift will be attributable to the workers' recollections of high wartime defense wages. Government experts warn that the opening or reopening of war plants in labor-scarce areas may lead to "raids" upon the skilled personnel of the areas. To protect the skilled labor supply, the USES is opposed to drafting workers now employed or capable of doing specialized defense work, and is now conferring with draft officials to work out deferments.

Under USES recommendations, deferments for skilled and essential occupations would include all defense work and supporting activities, such as transportation, utilities, medical workers, police, firemen and sanitation employees.

New A.F.S. MEMBERS

Period July 15 — August 15 : Membership conversions reached a high for the year with 13 conversions to sustaining and 10 conversions to company membership. In addition, 117 new members, including two company members, joined A.F.S. Leading chapter was Western New York with 21 new members. The sixth student chapter is organizing at the University of Illinois where 15 students joined the Society.

CONVERSIONS

Company to Sustaining

Aluminum Industries, Inc., Cincinnati—Walter J. Klayer, Wks. Mgr. (Cincinnati Chapter).
Atlantic Foundry Co., Akron, Ohio—Charles Reyman, Sr., Pres. (Canton Chapter).
Dee Brass Foundry, Houston Texas—Jake Dee, Owner. (Texas Chapter).
Ferro Machine & Fdry. Co., Cleveland—John M. Price, Pres. (Northwestern Ohio Chapter).
General Iron Works Co., Denver, Colo.—M. R. Nelson. (Timberline Chapter).
Golden's Fdry. & Mach. Co., Columbus, Ga.—George J. Golden, Pres. (Non-Chapter).
Indianapolis Brass & Aluminum Fdry., Inc., Indianapolis—Ivan W. Smith, Pres. (Central Indiana Chapter).
M & H. Valve Fittings Co., Anniston, Ala.—Charles S. Martin, Pres. & Gen. Mgr. (Birmingham Chapter).
Malleable Iron Fittings Co., Branford, Conn.—A. H. Jameson, Mgr. Cst. Sls. (Non-Chapter).
Maritime Steel & Fdries, Ltd., New Glasgow, Que., Canada—Clyde F. Cameron, Mgr. (Eastern Canada & Newfoundland Chapter).
Minster Machine Co., Minster, Ohio—John F. Herkenhoff, Pres. (Cincinnati Chapter).
L. G. Perkins Co., Fresno, Calif.—L. G. Perkins, Owner. (Northern California Chapter).
Precision Dies & Castings, Ltd., Toronto, Ont., Canada—C. H. S. Bell, Mgr. (Ontario Chapter).

Personal to Company

American Radiator & Std. Sanitary Corp., Buffalo, N.Y.—B. T. Hain, Mgr. (Western New York Chapter).
G. A. Avril Smelting Corp., Cincinnati—George A. Avril, Pres. (Cincinnati Chapter).
Belmont Smelting & Refining Works, Inc., Brooklyn—George Henning, Jr., Pres. (Metropolitan Chapter).
T. H. Benners & Co., Birmingham, Ala.—T. H. Benners, Jr. (Birmingham Chapter).
Brown Industries, Inc., Sandusky, Ohio—Karl T. Rinderle, V.P. & Gen. Mgr. (Northeastern Ohio Chapter).
Frank D. Campbell, Chicago—Consulting Engineer. (Chicago Chapter).
The Electric Materials Co., North East, Pa.—Carl Duryee, Act. Frm. Fdry. (Northwestern Pennsylvania Chapter).
Foundries Materials Co., Coldwater, Michigan—Douglas J. Strong, Pres. (Central Michigan Chapter).
Grede Foundries, Inc., Iron Mountain Div., Iron Mountain, Mich.—James Hawtin, Wks. Mgr. (Wisconsin Chapter).
Wysong & Miles Co., Greensboro, N.C.—Orville C. Hoover, Fdry. Supt. (Non-Chapter).

NEW COMPANY MEMBERS

Arrow Foundry Co., Montague, Mich.—Walter M. Klaus, Pres. (Western Michigan Chapter).
Powermatic Ventilator Co., Cleveland—J. B. Shaver, Pres. (Northeastern Ohio Chapter).

CENTRAL ILLINOIS CHAPTER

James L. Leach, Asst. Prof., University of Illinois, Urbana, Illinois.

CENTRAL MICHIGAN CHAPTER

Donald L. Gilchrist, Sls. Engr. Foundries Materials Co., Coldwater, Mich.
Richard K. Moore, Gen. Mgr., Foundries Materials Co., Coldwater, Mich.

CENTRAL OHIO CHAPTER

Glen A. Beaumont, Blast Furnace Supt., Jackson Iron & Steel Co., Jackson, Ohio.
James H. Rickey, Jr., Prod. Engr., The Ironton Fire Brick Co., Ironton, Ohio.

CHESAPEAKE CHAPTER

Harvey E. Henderson, Asst. Plant Met., Lynchburg Foundry Co., Concord Depot, Va.
R. N. Lancaster, Plant Met., Lynchburg Fdry. Co., Lynchburg, Va.

CHICAGO CHAPTER

William Cook, Gen. Turn. Frm., Carnegie-Illinois Steel Corp., Chicago.
Charles M. Gattis, Frm. Relief, Carnegie-Illinois Steel Corp., Chicago.
Roy J. Keeley, Gen. Turn. Frm., Carnegie-Illinois Steel Corp., Chicago.
Stanley J. Novak, Fdry. Insp., Carnegie-Illinois Steel Corp., Chicago.
Clark M. Price, Jr., Process Engr., The Fahralloy Co., Harvey, Ill.
Joseph J. Schmidt, Salesman, Lindberg Engineering Co., Chicago.
Barney Szymanski, Frm.-Relief, Carnegie-Illinois Steel Corp., Chicago.
R. C. Trimble, American Brake Shoe Co., AMSCO Division, Chicago Hgts., Ill.
Kenneth J. Turner, Sales Engr., Cleveland Quarries Co., Chicago.

CINCINNATI CHAPTER

Bruce Boecker, Sand Tech., The Minster Machine Co., Minster, Ohio.
Stanley Garfinkel, Stud., University of Cincinnati, Cincinnati.

E. CANADA & NEWFOUNDLAND CHAPTER

D. Harrison, Molder, Massey Harris Verity Plant, Brantford, Ont., Canada.

METROPOLITAN CHAPTER

R. Wayne Kraft, Jr., Asst. Met., American Brake Shoe Co., Mahwah, N.J.
John Necco, Plant Supt., National Foundry Co. of N.Y., Inc., Hollis, N.Y.
J. H. Parsons, American Brake Shoe Co., Brake Shoe & Castings Div., New York.
Francis R. Pyne, Met., Metalloy Corp., Elizabeth, N.J.
Frank J. Russo, Met. Asst., American Brake Shoe Co., Mahwah, N.J.

MEXICO CHAPTER

Cornelius J. Hogan, Sales Engr., National Carbon-Eveready S.A., Monterrey, Mex.

MICHIANA CHAPTER

George Mittler, Mittler Supply Inc., South Bend, Ind.

NORTHEASTERN OHIO CHAPTER

***Powermatic Ventilator Co., Cleveland, Ohio. (J. B. Shaver, Pres.).**
J. J. Baum, Gen. Frm., National Tube Co., Lorain, Ohio.
Frank J. Bubsey, Stud., Case Institute of Technology, Cleveland.
B. W. Duncan, American Brake Shoe Co., Electro Alloys Div., Elyria, Ohio.
L. Tablett, American Brake Shoe Co., Electro Alloys Div., Elyria, Ohio.
P. Tompkins, American Brake Shoe Co., Electro Alloys Div., Elyria, Ohio.

NORTHERN CALIFORNIA CHAPTER

Earl Paltenghi, Secy., H. C. Macauley Co., Berkeley 2, Calif.

NORTHWESTERN PENNSYLVANIA CHAPTER

William J. Woods, Jr., Secy. & Treas., Pennsylvania Pulverizing Co., Pittsburgh, Pa.

OREGON CHAPTER

Dale Calkins, Patt. Fdry. Clerk, Electric Steel Foundry, Portland, Oregon.
William D. Clark, Cleaning Room Frm., Electric Steel Foundry, Portland, Oregon.
Henry I. Hanson, Cleaning Room Frm., Electric Steel Foundry, Portland, Oregon.
S. E. Lafler, Supt., American Brake Shoe Co., Brake Shoe & Castings Co., Portland, Ore.
J. H. Scheeland, Branch Mgr., Electric Steel Foundry Co., Portland, Oregon.

QUAD CITY CHAPTER

Chester C. Bergstrand, Frm., Union Malleable Iron Works, East Moline, Ill.
Robert D. Tolmie, Gen. Frm., Union Malleable Iron Works, Moline, Ill.

ST. LOUIS CHAPTER

Richard L. Jones, Asst. Works Mgr., American Steel Foundries, Belleville, Ill.
R. D. Malin, American Brake Shoe Co., AMSCO Division, St. Louis.
J. O'Meara, American Brake Shoe Co., AMSCO Division, St. Louis.
B. J. Sexauer, American Brake Shoe Co., National Bearing Div., St. Louis.
R. L. Williamson, American Brake Shoe Co., National Bearing Div., St. Louis.

* Company Members

SOUTHERN CALIFORNIA CHAPTER

W. C. N. Cormack, Supt., Hanford Foundry Co., San Bernadino, Calif.
Charles E. Gunselman, Cupola Leadman, Rich Mfg. Co. of Calif., Downey, Calif.
Kenneth D. Hoke, Pres., McGowan Co., Inc., Los Angeles, Calif.
George L. Markert, Secy., McGowan Co., Inc., Los Angeles, Calif.
K. W. Miller, Wood & Metal Patterns, Los Angeles, Calif.
Frank Pellegrino, Co-Owner, Monarch Aluminum Castings Co.,, Bell, Calif.
Lawrence R. Schwedes, Co-Owner, Lawrence Laboratory, Santa Monica, Calif.
R. Wray, American Brake Shoe Co., AMSCO Division, Los Angeles, Calif.

TENNESSEE CHAPTER

Roger P. Egan, Frm., Ross Meehan Foundries, Chattanooga.
David L'heureux, Supv. of Standards Dept., Ross Meehan Foundries, Chattanooga.
Frank W. Love, Melter, Ross Meehan Foundries, Rossville, Ga.
William M. Merriman, Fdy. Frm., Ross Meehan Co., Chattanooga.
Henry W. Waller, Jr., Ross Meehan Foundries, Chattanooga.
J. A. Weaver, Partner, Chattanooga Pattern Works, Chattanooga.

WESTERN MICHIGAN CHAPTER

***Arrow Foundry Co., Montague Mich. (Walter M. Klaus, Pres.).**
Raymond E. Gilbert, Mech., Engr., Great Lakes Founders & Mach. Corp., Ludington, Mich.
Benjamin Head, Sales Dept., Cadillac Malleable Iron Co., Cadillac, Mich.
Louis P. Rehbein, Vice Pres., Great Lakes Founders & Mach. Co., Ludington.
Henry Smith, Frm., Cadillac Malleable Iron Co., Messick, Mich.
Clarence Springberg, Frm. Cadillac Malleable Iron Co., Cadillac, Mich.

WESTERN NEW YORK CHAPTER

John Arnott, Asst. Frm., American Radiator & Standard Sanitary Corp., Buffalo.
John J. Brylinski, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Bruno Dollman, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Edwin C. Durkee, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Walter Handzel, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
George Heidenreich, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Bertrand Holt, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Robert J. Ingham, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Louis Kania, Gen. Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Bert Kerr, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Roy Klopp, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Frank Logan, Gen. Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Edward F. Lorish, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Frank Mardel, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Edward J. O'Connell, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
William Sibole, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Julius Stopinski, Frm. American Radiator & Standard Sanitary Corp., Buffalo.
Jozef Switek, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Walter Wesolowski, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
Gordon M. Williams, Frm., American Radiator & Standard Sanitary Corp., Buffalo.
John Zaremba, Frm. American Radiator & Standard Sanitary Corp., Buffalo.

WISCONSIN CHAPTER

Arthur G. Heinrichs, Supv., Falk Corp., Milwaukee, Wis.
Lester E. Hoppe, Salesman, Badger Firebrick & Supply Co., Milwaukee, Wis.
Walter V. Napp, Salesman, Badger Firebrick & Supply Co., Milwaukee, Wis.

STUDENT CHAPTERS

UNIVERSITY OF ILLINOIS

Robert W. Bales, Stud., University of Illinois.
John J. Campbell, Stud., University of Illinois.
Roy K. Cannon, Stud., University of Illinois.
Gerald T. Crovey, Stud., University of Illinois.
Joseph M. David, Stud., University of Illinois.
Charles E. Drury, Stud., University of Illinois.
Robert Eagleton, Stud., University of Illinois.
Harold French, Stud., University of Illinois.
Morris G. Hocutt, Stud., University of Illinois.
Robert W. Klann, Stud., University of Illinois.
Philip Quebman, Stud., University of Illinois.
Charles Edwin Wadsack, Stud., University of Illinois.
Charles K. Waters, Stud., University of Illinois.
Edward Yencho, Stud., University of Illinois.
William F. Zumwalt, Stud., University of Illinois.

OUTSIDE OF CHAPTER

J. R. Lottes, American Brake Shoe Co., National Bearing Div., Meadville, Pa.
Chester Theodore Nowak, Stu., International Harvester Co., Memphis, Tenn.

Belgium

Schotmans Jean-Pierre, Met., S.A. Usines Emile Henricot., Court-St.Etienne.

Brazil

Vital Eisenberg, Chief Drftmn., Cia Ferro Brasileiro S.A., Estado Minas Gorais.
Jordao Vecchiatti, Engr., Elevadores Atlas, S.A., St. Andre.

England

Alan R. Abraham, "Glenholme," Rainworth Mansfield, Nottingham.
Michael S. Routley, Ealing Park Foundry Co. Ltd., London.
Robert Sutcliffe, Asst. Mng. Dir., Fordath Engineering Co., Birmingham.

France

Cie de Produits Chimiques, Electrometallurgiques, Alais Froges & Camargue, Chambery, Savoie.

Holland

E. M. M. Lips, Dr. Met., N. V. Philips Gloeilampenfabrieken, Eindhoven

India

Mansingh, Prop., Greysham & Co., Delhi.

South Africa

I. K. M. Scheepers, Organizing Mgr., National Anti-Waste & Conservation Organization, Johannesburg.

Technical Editors See Atomic Energy Operations at Oak Ridge Laboratory

AMERICAN FOUNDRYMAN *was represented in the small group of industrial and scientific editors which recently spent three days in New York, Washington, D.C., and Oak Ridge, Tenn., on a trip sponsored by the Atomic Energy Commission. Front row, left to right, are Anne Gardner, Modern Industry; George A. Stetson, Mechanical Engineering; A. B. Parsons, Mining and Metallurgy; Thomas J. Donovan, Tool Engineer; Walter J. Murphy, American Chemical Society publications; I. Stanley Wishoski, Industrial Heating; and H. F. Scobie,* AMERICAN FOUNDRYMAN; *Back row, left to right, are Colin Carmichael, Machine Design; Ernest E. Thum, Metal Progress; F. J. Antwerpen, Chemical Engineering Progress; Joseph Gilbert, Society of Automotive Engineers Journal; H. Schor, Product Engineering; and Howard Campbell, Modern Machine Shop.*

FOUNDRY Personalities

A.F.S. Past President **Lee C. Wilson** has been designated consultant to the National Security Resources Board. Specializing in foundry equipment, he will be with the machine tools division.

Mr. Wilson's immediate objective will be to survey the foundry equipment industry and prepare a report for the guidance of the Board in meeting any emergency. The work will indicate whether foundry

L. C. Wilson

equipment manufacturing facilities will be adequate in time of emergency.

Mr. Wilson's Washington address is: Mr. Lee C. Wilson, Old State Department Bldg., Washington 25, D.C. He will also conduct Board business from 1220 South Parkside Drive, Reading, Pa.

Mr. Wilson has broad experience in the foundry industry, having served in technical and management positions with a number of companies. After graduating from the Sheffield Scientific School of Yale University in 1907 with a mechanical engineering degree, he entered the sales department of Harbison-Walker Refractories Co. After a number of years he was named assistant to the vice president of the Chain Belt Co., Milwaukee, later becoming general sales manager. Transferring to Federal Malleable Co., Milwaukee, as secretary, Mr. Wilson later was elected vice-president and general manager. He was general manager of the Reading Steel Casting Division of American Chain & Cable Co., Inc., Reading, Pa., from 1931 to 1945. Before accepting his present appointment, Mr. Wilson represented several manufacturers.

Paul Queneau has been appointed metallurgical engineer of the International Nickel Co. of Canada and its subsidiaries. Mr. Queneau had been superintendent of research at International Nickel's mines and plants at Copper Cliff, Ont. With the company since 1934, he served as a lieutenant colonel in the Corps of Engineers during World War II, when he saw action in Normandy, Northern France, the Ardennes, the Rhineland, and Central Europe. He is a graduate of the Columbia School of Mines and attended Cambridge University in England. Mr. Queneau is a native of Philadelphia. He will be succeeded by **W. K. Sproule** as superintendent of research at Copper Cliff. Mr. Sproule was formerly chief physicist at the Copper Cliff Research Laboratory.

William J. Taylor, chief process metallurgist at Carnegie-Illinois Steel Corp., Chicago, resigned recently to join Exothermic Alloy Sales and Service, Inc.

Orville C. Hoover, owner of the Hoover Foundry Co., Indianapolis, was recently

O. C. Hoover

appointed foundry superintendent of the new plant of Wysong & Miles Co. at Greensboro, N.C. Mr. Hoover began his career as a molder in 1918 and has since served as metallurgist and superintendent of foundries in Indiana, Michigan, Ohio, and Alabama. He has served on both the A.F.S. Sand Research and Casting Inspection committees.

Public Relations Consultant **Walter Morrison** has been appointed director of Public Relations for the American Society for Metals, Cleveland. Mr. Morrison succeeds **Graves Taylor.**

C. E. Davies, national secretary of the American Society of Mechanical Engineers, was recently awarded an honorary degree of doctor of engineering by Clarkson College of Technology, Potsdam, N.Y.

Douglas W. Grobecker, formerly with the ABS Co., has joined the staff of the Chemistry and Metallurgy Division of the Los Alamos (N.M.) Scientific Laboratory of the University of California.

Frederick Stirbl, research metallurgist of the Crucible Steel Company of America, resigned recently to establish his own metallurgical consulting practice in New York City.

E. Wayne Everhart, formerly with the Glenn L. Martin Co., will head the Corrosion Laboratory of the Permanente Metals Corp.'s newly-created Research department at Spokane, Wash.

Dr. Robert F. Mehl of the Carnegie Institute of Technology has been named to the advisory committee to the Secretary of Commerce on the National Bureau of Standards. Dr. Mehl recently returned from Europe, where he delivered the Hatfield Memorial Lecture to the annual meeting of the British Iron and Steel Institute in London. He also addressed the Swedish Metallographers' Society and Royal Institute of Technology, Stockholm.

William J. White of Duquesne, Pa., has been appointed sales engineer of Superior

W. J. White

Foundry, Inc., Cleveland, Ohio. Mr. White was formerly associated with the Columbia Radiator Co., McKeesport, Pa., as assistant to the general manager.

Edward H. Platz, Jr., has been appointed manager of alloy sales for Lebanon Steel Foundry, Lebanon, Pa. A graduate of Rensselaer Polytechnic Institute in 1916, Mr. Platz was a bomber pilot during World War I. Upon discharge, he joined the Duriron Co., Dayton, Ohio, where he specialized in castings corrosion research. He joined Lebanon in 1939 and has since

worked on the development of the engineering and metallurgical applications of alloy castings for jet and gas turbines.

Edward E. Marbaker, senior fellow of the Mellon Research Institute, was recently elected 1948-49 editor of the Journal of the American Ceramic Society. Mr. Marbaker had been serving as editor in a temporary capacity for the last nine months. Graduated cum laude from the University of Pennsylvania in 1910, Mr. Marbaker has held the Industrial Foundry Practice and Heavy Chemicals Fellowships at the Institute since 1921. Prior to that, he served as chief chemist with Westinghouse Electric Co. and the Cleveland Wire Division, National Lamp Works, General Electric Co.

Dr. Heinrich Ries, chairman of the A.F.S. Sand Division, retired head of the Department of Geology at Cornell University and a Past President of the American Ceramic Society, was married June 7 to Mrs. Adelyn Halsey Gregg at Ithaca.

William B. Sullivan, manager of alloy sales for the Lebanon Steel Foundry, Lebanon, Pa., recently retired after serving 45 years as a steel executive and a pioneer

W. B. Sullivan

in the development of high temperature alloy castings. Mr. Sullivan is credited with having initiated the first American research work devoted to the development of high temperature, heat-resistant alloys and is the holder of a number of patents in this field. In the early 30's, Mr. Sullivan was appointed NRA chairman for the steel industry's Alloy Casting Group. In 1933, he was one of the organizers of the Alloy Casting Association, predecessor of the Alloying Casting Institute, and served two terms as its president.

Lawrence J. White recently became affiliated with the Wellman Bronze & Aluminum Co. as its Chicago area representative. Mr. White, who has been associated with the metal and machinery industry for 20 years, is a graduate of Northwestern University and a veteran of the original Tank Corps in World War I. He will make his headquarters at the Uptown National Bank Bldg., Chicago.

(Continued on Page 82)

A.F.S. CHAPTER DIRECTORY

BIRMINGHAM DISTRICT CHAPTER
Secretary-Treasurer, F. K. Brown, Adams, Rowe & Norman, Inc.

BRITISH COLUMBIA CHAPTER
Secretary-Treasurer, L. P. Young, A-1 Steel & Iron Foundry Ltd.

CANTON DISTRICT CHAPTER
Secretary, Robt. L. Fasig, Ashland Malleable Iron Co.

CENTRAL ILLINOIS CHAPTER
Secretary-Treasurer, Vern M. Swango, Caterpilla Tractor Co.

CENTRAL INDIANA CHAPTER
Secretary, Jack Giddens, International Harvester Co.

CENTRAL MICHIGAN CHAPTER
Secretary-Treasurer, George Petredean, Calhoun Foundry Co.

CENTRAL NEW YORK CHAPTER
Secretary, David Dudgeon, Jr., Utica Radiator Co.

CENTRAL OHIO CHAPTER
Secretary, D. E. Krause, Gray Iron Research Institute.

CHESAPEAKE CHAPTER
Secretary-Treasurer, C. A. Robeck, Gibson & Kirk Co.

CHICAGO CHAPTER
Secretary, V. M. Rowell, Velsicol Corp.

CINCINNATI DISTRICT CHAPTER
Secretary, B. A. Genthe, S. Obermayer Co.

DETROIT CHAPTER
Secretary, J. N. Phelps, Vanadium Corp. of America.

EASTERN CANADA AND NEWFOUNDLAND CHAPTER
Secretary, J. G. Hunt, Dominion Engineering Works Ltd.

EASTERN NEW YORK CHAPTER
Secretary Treasurer, Ugo Navarette, General Electric Co.

METROPOLITAN CHAPTER
Secretary, J. F. Bauer, Hickman, Williams & Co.

MEXICO CITY CHAPTER
Secretary, N. S. Covacevich, La Consolidada S.A.

MICHIANA CHAPTER
Secretary-Treasurer, V. S. Spears, American Wheelabrator & Equip. Co.

NORTHEASTERN OHIO CHAPTER
Secretary, R. D. Walter, Werner G. Smith Co.

NORTHERN CALIFORNIA CHAPTER
Secretary, Charles R. Marshall, Chamberlain Co.

NORTHERN ILLINOIS-SOUTHERN WISCONSIN
Secretary, F. W. Thayer, Gunite Foundries Corp.

NORTHWESTERN PENNSYLVANIA CHAPTER
Secretary, Reginald Harding, Pickands-Mather Co.

ONTARIO CHAPTER
Secretary-Treasurer, G. L. White, Westman Publications Ltd.

OREGON CHAPTER
Secretary-Treasurer, Geo. C. Vann, Northwest Fdry. & Fce. Co.

PHILADELPHIA CHAPTER
Secretary-Treasurer, W. B. Coleman, W. B. Coleman & Co.

QUAD CITY CHAPTER
Secretary-Treasurer, C. R. Marthens, Marthens Co.

ROCHESTER CHAPTER
Secretary-Treasurer, L. C. Kimpal, Rochester Gas & Electric Corp.

SAGINAW VALLEY CHAPTER
Secretary-Treasurer, Raymond H. Klawuhn, General Fdry. & Mfg. Co.

ST. LOUIS DISTRICT CHAPTER
Secretary, P. E. Retzlaff, Busch-Sulzer Bros.-Diesel Engrg. Co.

SOUTHERN CALIFORNIA CHAPTER
Secretary, J. E. Wilson, Climax Molybdenum Co.

TENNESSEE CHAPTER
Secretary-Treasurer, Herman Bohr, Jr., Robbins & Bohr.

TEXAS CHAPTER
Secretary-Treasurer, P. B. Croom, Houston Pattern Works

TIMBERLINE CHAPTER
Secretary, John W. Horner, Jr., Slack-Horner Brass Mfg. Co.

TOLEDO CHAPTER
Secretary-Treasurer, R. H. Van Hellen, Unitcast Corp.

TRI-STATE CHAPTER
Secretary, D. A. Mitchell, Progressive Brass Mfg. Co.

TWIN CITY CHAPTER
Secretary-Treasurer, L. K. Polzin, Minneapolis Chamber of Commerce.

WASHINGTON CHAPTER
Secretary-Treasurer, Fred R. Young, E. A. Wilcox Co.

WESTERN MICHIGAN CHAPTER
Secretary, S. H. Davis, Campbell, Wyant & Cannon Fdry.

WESTERN NEW YORK CHAPTER
Secretary, R. E. Walsh, Hickman, Williams & Co.

WISCONSIN CHAPTER
Secretary, W. W. Edens, Badger Brass & Aluminum Fdry. Co.

39

STUDENT CHAPTERS

UNIVERSITY OF MINNESOTA *Secretary,* Harvey Sauby

MISSOURI SCHOOL OF MINES *Secretary,* Martin L. Slawsky

OHIO STATE UNIVERSITY *Secretary-Treasurer,* Eldon Boner

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Secretary-Treasurer, Martin J. O'Brien

OREGON STATE COLLEGE *Secretary,* John P. Meece

UNIVERSITY OF ILLINOIS *Secretary,* Robert W. Bales

6

These past chairmen of the Central Indiana Chapter were honored at a recent meeting of the Chapter by having a table all their own. They are, left to right: Raymond Davis, National Malleable & Steel Castings Co.; B. P. Mulcahy, Indianapolis foundry consultant; J. R. Wagner, Electric Steel Castings Co.; J. P. Lentz, International Harvester Co., all of Indianapolis; and Richard Bancroft, Perfect Circle Co., New Castle, Ind.

CHAPTER ACTIVITIES NEWS

At the speakers' table at the June 15 meeting of the Eastern New York Chapter were, left to right, Kenneth Echard, Eddy Valve Co.; Chairman A. C. Andrew, American Locomotive Co.; Guest speaker V. C. Reid, City Pattern Foundry & Machine Co., Detroit; Retiring Chairman C. E. Killmer, Sr., Swan-Finch Oil Corp.; National Director John M. Robb, Jr., Hickman-Williams Co., Philadelphia; J. A. Wettergreen, Bucyrus-Erie Co.; R. Wickes, E. F. Houghton & Co.; C. Blumenaur, Albany Castings Co., Inc.

Northern California

J. F. Mainzer
Pacific Brass Foundry
Publicity Chairman

RETIRING PRESIDENT Andrew Ondreyco, Vulcan Foundry Co., Oakland, was honored by the Northern California Chapter at its July 29 meeting, held at the 365 Club, San Francisco. During the meeting, which was purely social, Past President Ondreyco was presented with a beautiful pen and pencil set.

New chapter officers who presided for the first time at the July meeting are: President George McDonald, H. C. Macauley Foundry Co.; Vice President J. L. Francis, Vulcan Steel Foundry Co.; Secretary Charles Marshall, Chamberlain Co.; and Treasurer F. A. Mainzer, Pacific Brass Foundry.

Central Indiana

W. K. Mitchell
L. W. & W. K. Mitchell Co.
Chapter Reporter

ADVANCE PLANS for the Chapter's Annual Stag Picnic, to be held September 25 at the Lakeshore Country Club, Indianapolis, were announced at a chapter directors'

preliminary meeting, held August 2 in Minneapolis.

The committee in charge of arrangements includes Chapter Chairman Robert Langsenkamp, Langsenkamp-Wheeler Brass Works; A. E. Murphy, Hickman Williams Co.; and Ralph Thompson, Electric Steel Castings Co. Subcommittees to have charge of various activities at the picnic, have also been chosen.

The affair will include golf, horseshoe pitching and baseball tourneys, lunch, a chicken dinner and the awarding of numerous door prizes. Funds are provided by donations from individuals and companies interested in the industry.

Tri-State

R. W. Trimble
Bethlehem Supply Co.
Retiring Chapter Chairman

THE ANNUAL STAG PARTY of the Tri-State chapter was held at Veteran's Hut, Tulsa, June 18. One hundred and fifteen members and guests attended the party which included a buffet dinner, music, and floor show, arranged by M. C. Helander, Empire Pattern and Foundry Co.

Retiring Chapter Chairman R. W. Trimble, Bethlehem Supply Co., introduced the incoming officers and directors. At a short Board meeting held during the party to select candidates for membership on the 1949 National Nominating Committee, the following were named: Paul S. Coman, Coman Pattern Works, and Anton Johnson, Oklahoma Steel Castings Co.

Saginaw Valley Boards Meet

Members of the incoming and outgoing executive boards of the Saginaw Valley Chapter posed for these two photographs at a meeting held in Frankenmuth, Mich., June 14. Above, the 1946-47 board. Left to right: J. F. Smith, Chevrolet Gray Iron Foundry; L. L. Clark, Buick Motor Division, General Motors Corp.; Maurice Godwin, Bostick Foundry Co.; O. E. Sundstedt, General Foundry & Mfg. Co.; G. A. Tobias, General Motors Institute; M. V. Chamberlin, Dow Chemical Co.; K. H. Priestley, Vassar Electroloy Products, Inc.; L. A. Cline, Saginaw Foundries Co.; and E. H. Bankhard, Buick Motor Division, General Motors Corp. Below, the 1948-49 executive board. Left to right: Messrs. Chamberlin, Clark, Godwin; R. H. Klawuhn, General Foundry & Mfg Co.; Messrs. Sundstedt and Cline; N. J. Henke, Central Foundry Division, General Motors Corp.; Robert Calkins, Clio Foundry, Inc.; A. E. Edwards, Chevrolet Gray Iron Fdry.; and Mr. Tobias.

Program Chairman John Russo of the Southern California Chapter proudly exhibits his gift pen and pencil set to, left to right: Secretary Charles Marshall; Vice President James Francis and President G. McDonald.

Chapter Meetings

SEPTEMBER 17
ONTARIO
Royal Connaught Hotel, Hamilton
J. W. NUTTALL
Canadian Westinghouse Co., Ltd.
"Supervisor Training"

WASHINGTON
Engineers' Club, Seattle
BRUCE L. SIMPSON
National Engineering Co.
"The History and Development of the Castings Industry"

B. L. Simpson

SEPTEMBER 20
QUAD CITY
Fort Armstrong Hotel, Rock Island, Ill.
W. R. JAESCHKE
Whiting Corp.
"Cupola Melting Control"

SEPTEMBER 24
TEXAS
San Antonio
W. B. MCFERRIN
Electro Metallurgical Corp.
"Casting Defects"

SEPTEMBER 25
CENTRAL INDIANA
Lake Shore Country Club, Indianapolis
STAG OUTING AND PICNIC

SEPTEMBER 27
NORTHWESTERN PENNSYLVANIA
Moose Club, Erie
E. T. KINDT, JR.
Kindt-Collins Co.
"Patternmaking"

OCTOBER 1
WESTERN NEW YORK
Hotel Sheraton, Buffalo
N. J. SCHWANHAUSSER
Worthington Pump & Machinery Corp.
"Business Conditions"

OCTOBER 4
CENTRAL ILLINOIS
Jefferson Hotel, Peoria
FRANK STEINEBACH
Penton Publishing Co.
"The Foundry Industry"

METROPOLITAN
Essex House, Newark, N.J.
HAROLD BOGART
Ford Motor Co.
"Automotive Castings"

OCTOBER 5
MICHIANA
Whitcomb Hotel, St. Joseph, Mich.
CLYDE R. POWELL
Endicott-Johnson Corp.
"Influencing Human Behavior"

W. B. McFerrin

OCTOBER 7
TWIN CITY
Cover Wagon, Minneapolis
FRANK STEINEBACH
Penton Publishing Co.
"The Foundry Industry"

SAGINAW VALLEY
Fischer's Hotel, Frankenmuth, Mich.
LESTER B. KNIGHT
Lester B. Knight & Associates, Inc.
"Modernization of Foundries"

OCTOBER 8
SOUTHERN CALIFORNIA
Rodger Young Auditorium
CLYDE A. SANDERS
American Colloid Co.
"Modern Progress in the Foundry"

OCTOBER 11
CENTRAL OHIO
Chittenden Hotel, Columbus
R. L. LEE
General Motors Corp.

OCTOBER 12
N. ILL.-S. WISCONSIN
Hotel Senate,
Freeport, Ill.
J. A. GITZEN
Delta Oil Products
"Chemical, Physical and Mechanical Properties of Binders Used in Cores and Molds"

OCTOBER 14
NORTHEASTERN OHIO
Cleveland Club,
Cleveland
S. D. MARTIN and S. W. HEALY
General Motors Corp.
"Better Methods"
Lecture with Demonstration

OCTOBER 15
NORTHERN CALIFORNIA
Orinda Country Club
ANNUAL STAG PARTY & GOLF TOURNAMENT

BIRMINGHAM DISTRICT
Tutwiler Hotel,
Birmingham
GEORGE K. DREHER
Foundry Educational Foundation
"Education for the Foundry"

TRI STATE
Mayo Hotel,
Tulsa
THOMAS BARLOW
Eastern Clay Products Co.
"Gates and Risers"

Thomas Barlow

CENTRAL NEW YORK
Mark Twain Hotel,
Elmira
H. W. DIETERT
Harry W. Dietert Co.
"Relationship Between Sand Control and Casting Defects"

NEW Foundry Products

Readers interested in obtaining additional information on items described in New Foundry Products should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.

Laboratory Shakers

SP1—Eberbach Laboratory Shakers are designed to provide the right carrier for the individual container to be shaken, and a variety of speeds to produce the agitation rate required. Three basic carriers are included in the new line. Featured shaker is the variable speed model with utility box carrier for shaking various sizes and shapes of containers. The speed of this model can be adjusted to provide optimum mixing rate, dependent upon shape of the container and viscosity of the liquid. Also included in the new line is the Power-Stir, a rheostatically-controlled electric stirring mechanism with speeds of 500 to 2400 rpm without load.

Rental Heating Equipment

SP2—Induction Heating Corp. announces that, for the first time, induction and dielectric heating equipment is being made available to industry under a rental-purchase plan. Under the plan, equipment may be rented on a monthly basis with the option to buy at any time. A portion of the rental payments form an equity towards outright purchase. No capital investment is required.

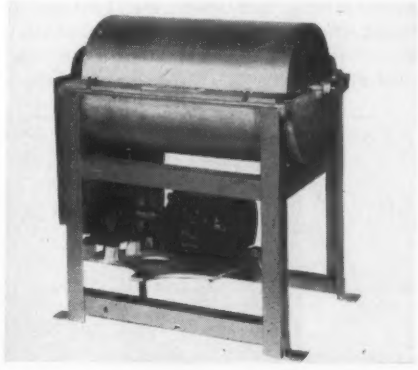
Dust Collector Conveyor

SP3—A standard design pipe conveyor for the purpose of removing accumulated dry dust from collector hoppers has been developed by Hapman Conveyors, Inc.

The Hapman conveying system, utilizing rubber flighted sealed pin chains, solves the problem of abrasive dust handling. With all-round rubber flights in restricted pipe sections, operation under varied pressure or vacuum conditions is easily accomplished. By installing the conveyors, dust hopper gates can be dispensed with. Dust-tight connections employed between the bottom of the hoppers and the carrying run of the conveyor pipe prevents loss of dust and results in a self-sealing unit. One daily collection of dust by means of a truck outside the building will remove all dust hazards within buildings and will result in a considerable savings in labor. One conveyor can receive dust from a series of collector bins and convey or elevate to any height or distance.

Core Pasting Machine

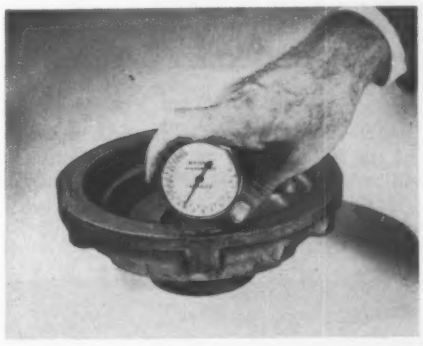
SP4—Recommended for the pasting of cores for all types of castings, the Economy Core Pasting Machine, developed by Valley Mfg. Inc., is reported by the manufacturer to have effected savings as high as 50 per cent on pasted cores with chambered ports requiring good venting, and on half-round stock cores, flat slabs, etc. Two or three persons can work on one machine at the same time, pasting both small and large cores. Operated by a ¼ hp motor, with other sizes available upon specification, the machine features a cast



aluminum drum, speed reducer running in oil, flexible coupling between motor and reducer, welded steel frame 14 x 18 in. at base, height 16 in. Also announced by the Valley Mfg. Co. is the Wheel-Over Core Machine, which the manufacturer claims will draw a perfect core every time. Can be operated by inexperienced employee with only 30 minutes instruction. Machine will draw core box 1 in. deep or 9 in. deep and has been designed purely as a production machine to make cores which have in the past been made on benches. Machine operates on compressed air and is of 80 per cent cast aluminum.

Brinnell Hardness Reader

SP5—A direct-reading Brinnell hardness number indicator has been developed by the Harry W. Dietert Co. The Brinnell Hardness Reader is constructed to fit into the hand, with dial calibrated to read in Brinnell Hardness numbers. Two standard dial calibrations are available; one for the 10 mm ball diameter with 3000 kg load; and the other for the 10 mm ball diameter with 500 kg load. Special dials can be made to order. In using the Reader, hardness impressions are made in the usual manner. The Reader is then pressed against the piece under test until its ball point enters the impression. The hand of the Reader will then point to the correct



Brinnell hardness without the use of a conversion table. Will record on machined, rough ground or as cast surfaces with accuracy equivalent to that of conventional microscope and conversion table.

Combustion Tube

SP6—A combustion tube, developed by McDanel Laboratories and marketed by Burrell Technical Supply Co., is made from pure zirconium silicate and is recommended for combustion work requiring gas-tight tubes for temperatures up to 2900 F. The tubes are fixed at a melting point of approximately 3100 F, thus assuring maximum temperatures without distortion. Zircum tubes are smooth, straight, and true to both bore and wall thickness, are available in a variety of lengths and diameters, and have excellent resistance to heat shock.

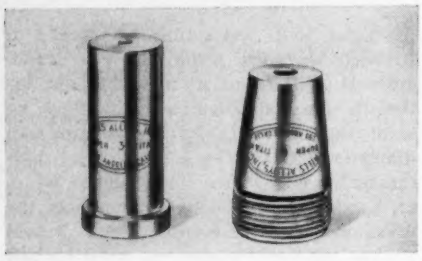
Die Casting Machine

SP7—A small, air-operated die casting machine, the Model M55A/HF, manufactured by the DCMT Sales Corp., is designed for quick, economical casting of small parts in zinc alloy, utilizing low-cost single cavity dies operating at high speed. The machine can maintain a production rate of 20,000 shots per week but is simple and light. New features include optional hand and foot controls and a completely new air system, with pilot and ram valves integral. Machine carriage is undercut

for downpulls and ejecting large castings. Base plate is adjustable to allow the use of die blocks of any required thickness. Pot is of new type, using hydraulic suction to fill the cylinder. Porthole at base of pot allows all metal to be used before refilling becomes necessary. Ejector boxes are of new, quick-release type.

Blasting Nozzles

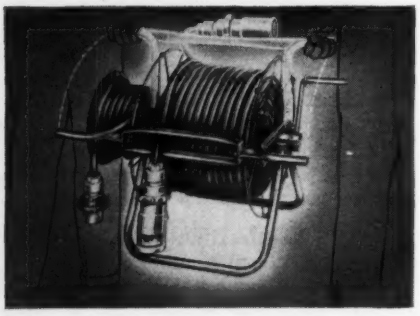
SP8—Available with either Kirksite or steel jackets, the Super Titan line of blasting nozzles, manufactured by Mills Alloys, Inc., features a special tungsten carbide



liner, and is available in lengths of from one to six inches with bores ranging from 1/16 to 5/8 in. in increments of 1/16 in. The nozzles will thus fit all makes of blasting machines with the aid of stock adapters.

Powereel

SP9—A portable reel designed to house up to 300 ft of 3/4 in., No. 12, four-conductor cable or its equivalent. Twin handles make two-man carrying of heavy cable easy work. A feature of the frame is the



use of tubular steel supports as sled runners to facilitate passing the reel in and out of trucks, etc. Designed for use with any phase current, the reel is rated 75 amp at 220 volts. Particularly adapted to industrial uses where fast, portable power facilities are required, the reel can furnish 1000 ft of co-axial cable whenever and wherever needed. Manufactured by the Industrial Electrical Works, the Powereel's features include adjustable brake and lock, free-running crank handle and adjustable reel flanges for winding short cables.

Flue Gas Analyzer

SP10—A flue gas analyzer for continuously indicating and recording stack gases has been developed by the Davis Emergency Equipment Co. The Davis Analyzer analyzes the composite of stack gases and gives a continuous indication of the completeness of combustion of fuel gases with air—properly indicating a deviation from ideal conditions. Instrument indicates if too much air or insufficient air is provided. Analyzer consists of a recorder and panel 2 ft wide x 6½ ft high and a flow panel to be mounted on or near the point of sampling, and is operated from a 110 volt, 60-cycle power supply employing a Wheatstone Bridge and analysis cell for measuring thermal conductivity of composite stack gases.

Flat-Belt Conveyor

SP11—The redesigned Haiss Model 481 Flat Belt Conveyor has capacities of 70 to 100 tons per hour and is furnished with belt widths of from 14 to 18 inches in lengths ranging from 20 to 40 ft. It is driven by either air or watercooled engine or by electric motor with protective housing. Exclusive features in the new model are: rubber pulley lagging, cam-adjusted feed and pulley, adjustable scraper plate tip, and rigid channel construction mast type truck with swivel wheels (optional). Uses include movement of coal and coke from pile to truck; radial storage installations, and unloading hopper bottom cars. Specifications and dimensions are available on request.

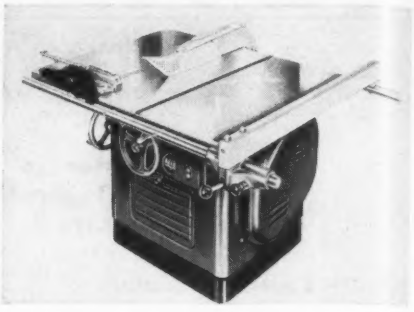
Electric Box Furnace

SP12—Accurately controlled temperatures from 300 F to 2000 F are available in the model VK-6 Cooley Electric Box Furnace, which permits not only hardening and high temperature work, but low temperature applications such as tempering or drawing of steels, non-ferrous heat treating, etc. With its 8 x 6 x 14 in. chamber the Model VK-6 is useful for tool and die work, production heat treating of small parts, testing and other work within its range where controlled heating is essential. Power capacity is 4650 watts. Rapid and uniform heating is assured by six-embed-

ded type heating elements. Furnace heats from cold to 2000 F in 1½ hrs, or in half that time after overnight shutdown. Bulletin 73-A is available.

Tilting Arbor Saw

SP13—A 12-in. tilting arbor saw with a capacity comparable to that of a saw with a 16-in. blade has been developed by the Delta Mfg. Division of the Rockwell Mfg. Co. The saw can be used for aluminum, carbon and like materials virtually impossible to handle with ordinary saw and can be set for speeds of 1800, 2400 or 2600 rpm. Used with either a three or five-hp motor, the tilting arbor saw has both motor and arbor on a common cradle, with four-belt drive for greater flexibility. The



12-in. blade is capable of tilting to the right at a 45° angle. Work is supported in front of the saw blade by a table space of 16 in. Table itself is 38 in. long and four ft. wide.

Welding Electrode

SP14—A welding electrode that can make machineable electric welds at amperages in the 45-140 range on cast iron is announced by All-State Welding Alloys, Inc. The electrode has a nickel core and is recommended for use on cast iron where free machineability and color match are required, and for repair of cylinder heads and motor blocks because of the low amperage required and the ductility obtainable in the weld. Can be used on either a-c or d-c and is available in diameters of 3/32, 1/8 and 5/32 in.

Eye Sweep

SP15—A convenient first aid instrument for use in industries where workers are exposed to flying metallic fragments, filings or other foreign metal substance subject to magnetic attraction, the General Scientific Eye Sweep has one end fitted with a magnet for removing steel splinters and the other with a flexible loop for removing cinders, dust and other par-

ticles. Sterilization of the instrument will not diminish the magnetic qualities or affect the loop. A hard rubber carrying case is provided with each sweep.

When You Need VANADIUM

Product and Analysis	Form and Packaging	Uses
Ferrovanadium **High-Speed Grade** Vanadium—50 to 55% Silicon —1.50% max. Carbon —0.20% max.	Lump (10 lb. x down) and crushed (2 in. x down, and 1 in. x down). Packed in special containers.	Production of tool steels, engineering steels, high-strength structural steels, non-aging rimming steels, and special wear-resistant cast irons. Frequently used in combination with other alloying elements.
Special Grade Vanadium—50 to 55% Silicon —4.00% max. Carbon —1.00% max.	Crushed (2 in. x down, 1 in. x down, and 20 mesh x down). Packed in special containers.	
Open-Hearth Grade Vanadium—50 to 55% Silicon —8.00% max. Carbon —3.00% max.	Lump (10 lb. x down) and crushed (2 in. x down, 1 in. x down, ¼ in. x down, and 65 mesh x down). Packed in special containers.	
Vanadium Oxide (Fused) Vanadium Oxide (V_2O_5)—86 to 89% Sodium Oxide (Na_2O) —10% approx. Calcium Oxide (CaO) — 2% approx.	Black flaky material. Packed in paper-lined burlap bags containing about 60 pounds net.	Direct reduction in steelmaking furnaces, as in production of tool steels.
Vanadium Oxide (Red Cake) Vanadium Oxide (V_2O_5)—85% approx. Sodium Oxide (Na_2O) — 9% approx. Water (H_2O) —2.5% approx.	Red sand-like material. Packed in paper-lined burlap bags containing about 60 pounds net.	Source of vanadium oxide, catalyst for sulphuric acid manufacture, and for organic synthetic reactions. Color constituent in glass and ceramic glazes. Drier in paints and inks.
Vanadium Oxide (High Purity) Vanadium Oxide (V_2O_5)—99% approx.	Tan crystalline material.	Chemical for laboratory research.
Ammonium Metavanadate Ammonium Metavanadate (NH_4VO_3)—99% min.	White crystalline powder. Packed in 13-gallon capacity fiberboard drums.	Source of pure vanadium compounds used principally as catalysts. Intermediate in manufacture of vanadium compounds used for coloring ceramic glazes and glass, and for paint and ink driers.

Write, Wire or Call

ELECTRO METALLURGICAL SALES CORPORATION

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC **New York 17, N. Y.**

OFFICES: Birmingham • Chicago • Cleveland • Detroit
New York • Pittsburgh • San Francisco

Electromet
TRADE-MARK
Ferro-Alloys and Metals

In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario.

***Turn in your scrap promptly* and help increase steel production**

FOUNDRY Literature

Readers interested in obtaining additional information on items described in Foundry Literature should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.

Monthly Newsletter

SP101—U. S. Reduction Co., East Chicago, Ind., announces that its monthly newsletter for users of aluminum will be sent to readers of AMERICAN FOUNDRYMAN upon request.

Sand Preparation

SP102—Four new brochures have recently been published by the National Engineering Co. describing the company's new "Progressive" Sand Preparing Plant, the National Rotary Cooling Hood for use on the Simpson Mixer, Simpson Intensive Mixers, and National Foundry Materials Handling Equipment. Each brochure is illustrated and contains specifications, methods of operation and applications of the various products described.

Flax in Industry

SP103—Flax, a crop that has become almost as basic as steel to our national economy, and its many applications to industry, is described in a 24-page illustrated booklet put out by the Archer-Daniels-Midland Co. Cited among the roles played by flax in the foundry industry is its use in the making of Werner G. Smith core oils for castings. Core oils described in the booklet include Linoil, Super Linoil No. 38, M-510-E, NP-3 and Gold Bond.

Pallet Handling

SP104—Yale & Towne Mfg. Co. has just released a 20-page booklet describing the company's hand lift and Worksaver pallet trucks, their specifications and applications to industry. Profusely illustrated, the brochure contains photographs of actual applications of Yale lift trucks in the foundry and allied industries. Tables list mechanical and hydraulic lifting power and applications for each type of truck.

Practical Foundry Service

SP105—A two-page sheet, "Practical Foundry Service," issued recently by McNally-Pittsburgh Foundries, Inc., cites three main activities undertaken by the foundry for the benefit of its customers—specification cast iron, technical advice and production delivery—and explains McNally-Pittsburgh's formula for service.

Safety Aid Dial

SP106—A ready reference to aid anyone connected with safety, from the foreman to the manager of the Safety department, is the Davis Safety Aid Dial. The Dial provides quick reference for common safety hazard problems, which would otherwise require long hours of research work in safety manuals and texts. The two sides of the dial list 45 mechanical operations, with body, respiratory, head, eye and face protection for each. In addition, complete information and control measures on 55 gases, fumes and dusts are listed, plus a canister color chart and information on various types of gas protective equipment. The Dial is printed on heavy cardboard. Inner dial is turned until arrow points to problem. Answer is then visible through cut-out window.

Insulating Roof Tile

SP107—An eight-page booklet describing the physical properties and construction specifications of the new Kayo Insulating Roof Tile is now ready for distribution by the American Structural Products Co. The first section is devoted to a description of the product, which is designed to carry roof loads of 50 psf. The second section lists specifications, design data and applications. The balance of the book is devoted to technical data and includes tables on insulating value, strength, weight, dimensional stability and nail-holding power.

Silver Babbitt Metal

SP108—A new brochure and engineering brief on silver babbitt metal, made available by the National Bearing Division of the American Brake Shoe Co., is designed to show users of tin-base babbitt ways in which to overcome the current tin shortage and high production costs through use of No. 397 silver babbitt, an alloy of silver with lead that is equivalent in physical properties to tin-base babbitts. The brochure and engineering brief details physical properties and pouring procedures.

Glue Room Specialties

SP109—A booklet describing various glue room items of interest to all who use glue and allied products is available upon request from the Perkins Glue Co. The booklet, "Glue Room Specialties," recently revised, contains up-to-the-minute information on products designed to improve glue room efficiency.

Exothermic Products

SP110—Exomet, Inc., has just published a 12-page brochure giving general information on the properties and applications of the company's exothermic metallurgical products—Risotherm, Ladletherm, Ingotherm, Exoweld and Exocast. Illustrations and diagrams of ingot molds show the ways in which the various products react to reduce waste metals in risers, etc.

Conveyors

SP111—Bulletin No. 125-A, issued by the Robbins Conveyors Division of Hewitt-Robbins, Inc., illustrates 12 units manufactured by the Division. The back page briefly describes the Division's entire line of materials handling machinery.

Fire Fog

SP112—A bulletin describing Automatic Fire Fog equipment and installations has been made available by the Automatic Sprinkler Corp. of America. The bulletin illustrates Fire Fog, a system which applies water in the form of spray for the control and extinguishment of fires involving flammable liquids and solids.

Filler Metal Shapes

SP113—A comprehensive bulletin covering the use of wear-resistant, rolled and cast nickel-manganese filler metal shapes has been released by the AMSCO Welding Department of Canadian Ramapo Iron Works, Ltd., and is designed to show the wide range of dollar-saving applications where filler metal shapes permit the economical repair of equipment and parts. Illustrations show typical applications of the various shapes and outline repair procedure in considerable detail. Also featured is the use of nickel-manganese shapes in the welded fabrication of complete materials handling units.

Gray Iron Technical Bulletin

SP114—"Gray Iron—Its Mechanical and Engineering Characteristics and Details for Designing Cast Components," issued by the Gray Iron Founders' Society, was prepared by Thomas E. Eagan, chief metallurgist of the Cooper-Bessemer Corp., and C. O. Burgess, technical director of the Society, and is designed to assist engineers in specifying and designing gray iron components or parts. The 12-page booklet explains the fundamental considerations in designing castings and describes the

various engineering characteristics of gray iron. Single copies are gratis.

Sand Questions

SP115—American Colloid Co.'s latest addition to its "Brief Notes for Busy Foundrymen" series is a four page set of questions and answers on sand problems. The questions, those which are asked of American Colloid's service engineer, Clyde Sanders, most frequently, are such as "Do We Need a Synthetic Sand System?", "Should Molding Sands be Mulled?", "What Bond Should We Use?". These and several other important questions are answered briefly and authoritatively by Mr. Sanders.

Core Sand Chart

SP116—An aid to better core making—a volume to weight conversion chart for core sand mixtures, prepared by the Foundry Sand Department of the Werner G. Smith Co., Division of Archer-Daniels-Midland Co., is available free to all foundrymen. The chart enables the foundryman to determine easily what oil-sand ratio he is getting on weight basis, rather than on a volume basis. The weight ratio is more accurate because volume measurements are often subject to errors caused by temperature variations or a dented and misshapen bucket.

FOUNDRY FILMS

Films Listing Booklet

SP117—The Consumers Relations Department of the International Harvester Co., has for free distribution a 24-page booklet listing motion picture films embracing educational, industrial, historical, informative and entertaining classifications of films, which are available from Harvester at no cost except for transportation to and from destination. Particularly recommended for use by A.F.S. chapters is "The Right Material in the Right Place," a simple but highly informative treatment of the production of metals and their use in equipment, with particular emphasis on the reasons why certain materials are used in specific applications. With steel mill scenes, this film is of interest to industrial equipment users, school-age groups and to general audiences. 16mm. Approximate running time, 20 minutes.

Quality Control Film

SP118—"Records that Control Quality Control," and its companion film, "A Game of Chance," are combined in a 35-minute clinic presentation featuring a practical discussion on quality control records in manufacturing. These new soundslide films give a case history on how a user of Standard Register systems of record control reduced scrap rejects 23 per cent. The film demonstrates a system that provides control of men, material and machines through control of every original record written, and shows how management can be sure of receiving accurate reports on the effectiveness of the quality control program. The clinic presentation is made without charge by representatives of the Standard Register Co. as a basis for open discussion of quality control principles and problems dealing with basic records and systems of control.

"FALLS BRAND" ALLOYS

AMERICA'S LARGEST PRODUCERS OF ALLOYS

"FALLS" FLUX "B"

for

BRASS AND BRONZE

"FALLS" Flux "B" cuts melting costs by reducing rejections and scrap caused by dirty metal.

1. It increases metal yield about 3% by putting all the metal usually lost in the dross back into the molten metal.

2. It cleans, fluxes and removes gases, oxides and non-metallic impurities from all grades of brass and bronze.

A dry white powder, "FALLS" Flux "B" does not smoke, fume or smell, will not absorb moisture, and can be handled with the bare hands without burning the skin.

WRITE FOR COMPLETE DETAILS

NIAGARA FALLS

Smelting & Refining Division

Continental-United Industries Co., Inc.

BUFFALO 17, NEW YORK

PERSONALITIES

(Continued from Page 73)

R. E. Dahlin recently became affiliated with the Wellman Bronze & Aluminum Co., Cleveland, as the company's Western representative and will make his headquarters in Dallas, Texas, where he has been a resident for over 20 years.

P. F. Bauer of Allis-Chalmers Mfg. Co., Milwaukee, has been named manager of the company's central region and will have offices in the N. B. C. Building, Cleveland. A director of the Foundry Equipment Manufacturers Association, Mr. Bauer will organize a district for the administration of Allis-Chalmers affairs in Ohio, parts of Michigan, Pennsylvania, and West Virginia.

George W. Petersen, district sales manager, Chicago office of A. P. Green Firebrick Co., recently made a hole-in-one while playing golf at the Mount Prospect Country Club. Reported by Mrs. Petersen, the feat was witnessed by R. D. Denny, boiler superintendent, Kraft Foods, and M. L. Langschwager of Wickes Boiler Co.

C. J. Freund, dean of the college of engineering, University of Detroit, and member of the Advisory Group, A.F.S. Educational Division, was elected president of the American Society for Engineering Education for 1948-49. This was announced at the annual ASEE convention at the University of Texas, Austin.

Dean Freund has long been interested in industrial and engineering education and has participated for a number of years in A.F.S. activities, particularly apprentice training. An advocate of co-operative education, he is a member of the ASEE committee on relations with industry, and other committees, and last year served as vice-president of the organization.

G. L. White resumed the editorship of *Canadian Metals and Metallurgical Industries* recently when R. C. Tiplady left the publication. Mr. White will continue in charge of advertising for Westman Publications, Ltd. (*Canadian Metals, Canadian Chemistry & Process Industries, Laundry & Dry Cleaning Journal of Canada*). Editor from January 1938, when *Canadian Metals* was founded, until September 1946, he devoted the past two years to business and advertising matters.

Mr. White has been secretary-treasurer of the Ontario Chapter of A.F.S. for a number of years.

McArdle Equipment Co., 5724 Navigation Blvd., Houston, Texas, has been appointed district representative for Coleman Core and Mold Ovens in Texas and Louisiana, it is announced by the manufacturer, **The Foundry Equipment Co.,** Cleveland, Ohio.

John E. M. Hume, commercial vice president of the General Electric Co. and long prominent in the development and electrification of mines and steel mills, retired from the company after 41 years' service.

The George Haiss Mfg. Co., Inc., Philadelphia, a division of Pettibone-Mulliken Corp., announces the appointments of **H. D. Williams** as its representative in Pennsylvania and Southern New Jersey; **J. Benatar** as sales representative in the five boroughs of New York City; and **John F. Day** as representative for the northwestern New York and Pennsylvania.

Robert J. Fisher, who recently resigned as chairman of the A.F.S. Time Study and Job Evaluation Committee, has been appointed welding superintendent of the Falk Corp., Milwaukee.

W. M. Ball, Jr., has been appointed metallurgist and foundry consultant for R. Lavin & Sons, Inc., Chicago. Prior to accepting the position with Lavin, Mr. Ball had been for 27 years superintendent of the Magnus Brass Division of the National Lead Co. He has spoken before many meetings of the American Foundrymen's Society, the American Society for Metals, and the Foremen's Club of America on the subject of non-ferrous founding.

Robert W. Frank has been appointed president and general manager of the Lewis Foundry & Machine Division of the Blaw-Knox Co., Pittsburgh. Mr. Frank succeeds F. E. Walling, who recently resigned. Prior to his present appointment,

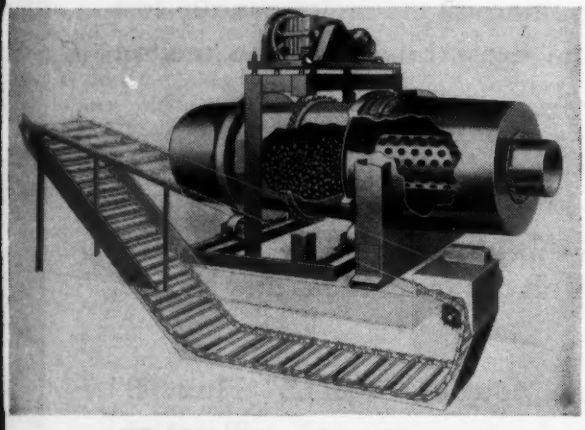
(Continued on Page 84)

RANSOHOFF FOUNDRY MILLS

AUTOMATIC STAR-RETURN WET CLEANING

YEAR AFTER YEAR,

in foundries great and small, these wet cleaning mills clean many types and sizes of castings and, based on actual figures, SAVE 30% TO 70%.



TWO TYPES

End-loading, end-unloading;
Side-loading, side-unloading

Illustrated is a cutaway view of a Ransohoff End-loading, end-unloading mill.

WRITE for Ransohoff Engineers to show you how to save.

LOWEST CLEANING COST PER TON

Save 30% to 70% ON YOUR CLEANING COSTS

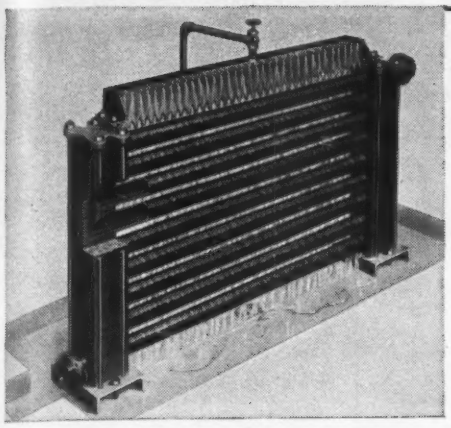
These mills are an investment that pays off BIG!

In addition, here are some of the superior features: no dust; no rust; no health hazards; no dust-collecting systems needed; mills are not self-destructive; no manual handling of stars . . . operation is easy . . . gentle . . . economical.

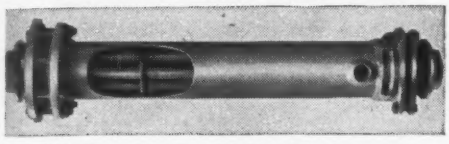
N. RANSOHOFF, Inc.

FIRST in Metal Cleaning Equipment

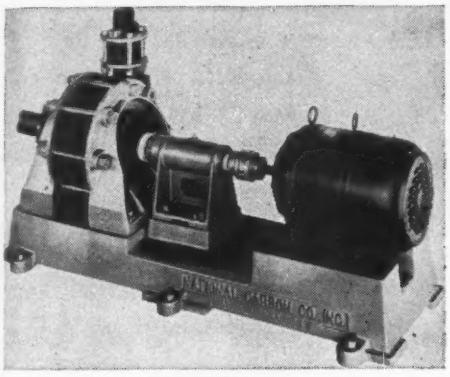
3 EAST 72ND STREET CINCINNATI 16, O.



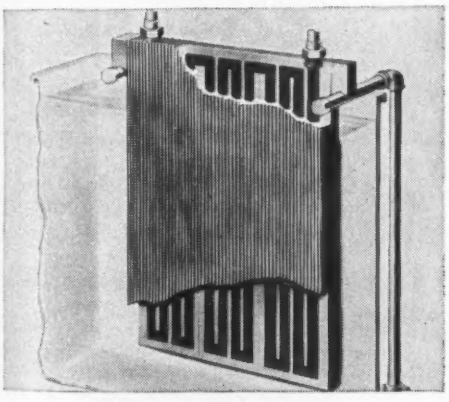
"Karbate" Sectional Cascade Cooler



"Karbate" Series 70 Heat Exchanger



"Karbate" Pump



"Karbate" Plate Heater

Carbon Brick for Tank Lining

How to lick corrosion if you pickle or plate metal . . .

USE NATIONAL CARBON PRODUCTS

FOR HEATING, cooling, pumping, and conveying the corrosive solutions used in pickling and plating metal, there's no better equipment than that made of "Karbate" brand Impervious Graphite. This material is chemically inert, immune to thermal shock, easy to machine and install, light in weight yet strong; and has a very high heat-transfer rate.

Operating experience has proved that "Karbate" equipment stands up in sulphuric, hydrochloric, and nitric-hydrofluoric pickling solutions . . . Parkerizing and Bonderizing baths . . . nickel, copper, tin, and zinc plating solutions . . . electro-polishing and Alumilite and Alzak processes.

"National" carbon brick is now extensively used for lining tanks that handle corrosive solutions — particularly nitric-hydrofluoric.

For more details on metal-cleaning systems of standard "Karbate" brand Impervious Graphite units and "National" carbon brick, write to National Carbon Company, Inc., Dept. AF.

These products sold in Canada by Canadian National Carbon Company Limited, Toronto

The registered trade-marks "Karbate" and "National" distinguish products of

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

UCC

30 East 42nd St., New York 17, N. Y.

Division Sales Offices:
Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

Big ones to little ones

One of the principal effects of alloy additions to gray iron is to reduce the "section sensitivity" to render more uniform the mechanical properties in castings having widely differing sections.

Molybdenum is an especially efficacious addition and is a great help to the foundryman because it enables the successful production of castings showing great variation in section of different parts, with small variations of hardness from section to section.

This property naturally solves many design and machinery problems for the user.

•

Send for our free booklet

"APPLICATIONS OF MOLYBDENUM CAST IRONS".

Authoritative engineering data on Molybdenum cast iron and its applications are furnished by Climax Molybdenum Company.

Climax Molybdenum Company
500 Fifth Avenue · New York City

® F.3.

PERSONALITIES

(Continued from Page 82)

Mr. Frank had been assistant general manager of the Lewis Foundry & Machine Division for three years, and was formerly superintendent of blooming and billet mills at the Duquesne plant of the Carnegie-Illinois Steel Corp. He holds a degree in metallurgical engineering from the University of Pennsylvania.

Joseph Chini has been appointed superintendent of the Foundry Division of the Sperry Gyroscope Co., Great Neck, L.I., N.Y., succeeding Stanley Tims, who recently resigned. After studying metal processes at the Velberter Hochschule in Germany, Mr. Chini came to the United States and has specialized in foundry techniques here for more than 30 years. Prior to joining Sperry as general foreman in 1943, Mr. Chini was superintendent of Howard Foundry, Chicago.

L. Edward Roby, Jr., superintendent of the Peoria Malleable Castings Co., Peoria, Ill., was recently appointed vice-president and secretary of the company. He has been with Peoria since 1935, when he joined as a chemist after graduation from Rensselaer Polytechnic Institute with a degree in chemical engineering.

George F. Comstock, chief metallurgist of the Titanium Alloy Mfg. Co., Niagara Falls, N.Y., for many years, was recently appointed director of research for the company's laboratories.

R. L. Cunningham, formerly executive vice president of the Ohio Ferro-Alloys Corp., has been elected president, succeeding the late L. G. Pritz. **W. W. Pritz,** vice president and works manager, will succeed to the executive vice presidency.

Elmer C. Zirzow, chairman of the A.F.S. Northeastern Ohio Chapter and chairman of the Core Test Committee of the A.F.S. Sand Division, has resigned as core room foreman of the National Malleable & Steel Castings Co., Cleveland, to accept the position of sand technologist at the Testing & Research Laboratories of Deere & Co. at Moline, Ill. Mr. Zirzow will be engaged in research on sand problems and will act as advisor to Deere's nine gray iron and two malleable foundries on sand research.

A. C. Monteith was recently elected vice president in charge of Engineering of the Westinghouse Electric Corp. Mr. Monteith began as a graduate student engineer with Westinghouse in 1923, and has since served as manager of Central Station Engineering, Industry Engineering, Headquarters Engineering and director of Education. He succeeds **Marvin W. Smith,** who recently became executive vice president of the Baldwin Locomotive Works.

Howard Kapner has been appointed head of the Glass Section of the laboratories of Sam Tour & Co., Inc. Mr. Kapner, who has conducted research on glass technology for the last eight years with the

(Continued on Page 86)

HIGH SILICON IRON

JISCO

SILVERY

The choice of Foundries who demand the best.

"Jisco" Silvery is a "must" in the modern foundry. Its use means better castings at lower cost. It supplies the needed silicon.

Full information upon request.

- **VIRGIN ORES**
- **LADLE MIXED**
- **MACHINE CAST**

THE JACKSON IRON & STEEL CO.
JACKSON, OHIO

Just Published

COPPER

As an Alloying Element in Steel and Cast Iron

By Dr. C. H. Lorig, B.S., M.S., Ph.D.
Assistant Director, Battelle Memorial Institute

and R. R. Adams, B.S., M.S.
Research Metallurgist, Battelle Memorial Institute

206 *pages*, 90 *tables and graphs*, $3.00

Here is a concise discussion of the techniques of employing copper as an alloying element in cast and wrought steel and iron. It includes a correlated treatment of the influences of copper in promoting the hardenability of steel . . . in raising the ratio of yield to tensile strength and other mechanical properties of various steel products . . . and in replacing a large portion of the silicon content in cast iron to improve wear resistance, machinability, scaling, and corrosion resistance. Covered thoroughly are the known characteristics of cast copper steels, wrought copper steels, copper cast iron, and copper malleable iron, including a representative list of the uses of each of these materials in various industries.

Order from
American Foundrymen's Society
222 W. Adams St.
Chicago 6, Ill.

MOLD YOUR FOUNDRY'S *Future*

with

MILWAUKEE JOLT SQUEEZERS

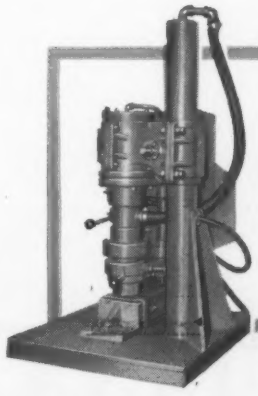
The future of your foundry depends largely on the type of equipment you use. Are your machines modern and efficient? Do they reduce costs to rock bottom? Will they stand up under strenuous production schedules?

Foundrymen employing MILWAUKEE Jolt Squeezers face the future with confidence. For these dependable molding machines are built for rugged service and are easy to operate. Designed to maintain the original parallelism between platen and table, there is no need to worry about ram-offs. The machine produces BETTER MOLDS in LESS TIME. Upkeep is low because renewable surfaces are provided at wearing points to simplify and reduce maintenance.

Yes Sir! Milwaukee Molders are ready to mold a prosperous future for your foundry. Get the facts — today!

(Above) No. 103 Stationary Jolt Squeezer with 10" squeezing piston. Accessible from 3 sides.

(Right) No. 124 Portable Jolt Squeezer with 12" squeezing piston, steel wheels, mold shelf.



NEW BENCH TYPE CORE BLOWER

Have you investigated the new MILWAUKEE-TACCONE Core Blower? It's designed to blow more intricate cores, as fast as the operator can remove them from the core box. Write for facts.

MILWAUKEE *Foundry Equipment Co.*

3238 W. PIERCE STREET, MILWAUKEE 4, WISCONSIN, U.S.A.

PERSONALITIES

(Continued from Page 84)

company, will handle all testing, laboratory and research work on glass for the firm.

A recent visitor to A.F.S. National Headquarters, Chicago, was **Robert Brown,** senior partner in the firm of Henry Brown & Co., ironfounders, at Irvine, Ayreshire, Scotland. Mr. Brown has been in this country and Australia for the purpose of observing foundry operations.

Frank J. Heyward recently resigned as plant superintendent of Horn Manufacturing Co., Fort Dodge, Iowa. He was formerly with American Chain and Cable Co., and during the war was a production engineer for the Forge and Foundry division of the War Production Board.

J. M. Haughey, formerly sales manager of the Industrial Division of Packard Motor Car Co., has been appointed to the newly-created post of sales manager of the Washington Iron Works, Seattle.

Obituaries

Walter F. Piper, 63, retired founder of the Beardsley & Piper Co., died when the plane which he was flying crashed enroute from Los Gatos, Calif., to Chicago. Inventor of many of the foundry industry's best-known machines and processes, Mr. Piper, together with E. O. Beardsley organized the company in 1918. During his 35 years in the foundry industry, Mr. Piper visited and worked with hundreds of foundries in the United States and abroad. A pioneer in the field of private flying, Mr. Piper, together with his partner, was critically injured in a flying accident in 1928, but two months later had recovered sufficiently to fly his plane to the A.F.A. Convention. He retired in 1947 from active service with the Beardsley & Piper Co., now a division of the Pettibone-Mulliken Co.

French E. Bassett, director of sales for the Central Foundry Division of the General Motors Corp., Saginaw, Mich., died as a result of a traffic accident on July 23. Mr. Bassett started work as a shipping clerk in the Saginaw Malleable Iron Foundry, in 1918, now a unit of the Central Foundry Division, and advanced steadily in the organization. During World War II, Mr. Bassett was manager of Saginaw Malleable's Danville, Ill., plant. When the war ended, he returned to Saginaw as director of sales for the Saginaw Foundry Division.

George M. Goepfert, 60, assistant to the works manager of the Belle City Malleable Iron Co., Racine, Wis., died in a hospital in that city on July 21. Mr. Goepfert began his career with the Racine Steel Castings Co., a division of Belle City, in 1911. He became steel foundry superintendent in 1916 and was made assistant to the works manager in 1944.

Neil C. Hurley, 78, chairman of the board of the Independent Pneumatic Tool Co., Aurora, Ill., died August 2 at his home in River Forest, Ill., following a heart attack. Mr. Hurley had been active in the company for the last 21 years and was succeeded as president of the company by his son, Neil, Jr., in 1944. Mr. Hurley and his brother, the late Edward N. Hurley, founded the Hurley Machine Co. in 1904 in Chicago. Mr. Hurley developed and marketed the first electric washing machine and vacuum cleaner and pioneered a score of other electric appliances.

George W. Dolan, 46, chairman of the board of directors of the Mathieson Chemical Corp., died July 24, after a brief illness. A graduate of Western Reserve University, Cleveland, in 1928, Mr. Dolan joined Mathieson as a salesman in 1930. He became, in rapid succession, manager of carbon dioxide sales, assistant general manager of sales, assistant to the president, vice president, executive vice president and president of the company. In April of this year he was named chairman of the board. A veteran of World War I, Mr. Dolan served as assistant district chief of the Chemical Warfare Service of the Army's New York Procurement District in World War II, and was a member of the National Industrial Conference Board.

Frederick A. Stevenson, 68, retired president of the American Car & Foundry Co., died last month a few hours after being admitted to a hospital while enroute from Florida to New York.

Check These Features of Buckeye Silica Firestone

Foundries everywhere are cashing in on the extra long life and efficiency provided by Buckeye Silica Firestone. For lining and patching the melting zone of cupolas, it is recommended as the finest refractory material you can use.

Realize the extra advantages of Buckeye. Send today for complete details regarding its use for your particular requirements. Our engineers will gladly cooperate in the solution of your problems.

THE CLEVELAND QUARRIES COMPANY
Refractory Department
1740 East Twelfth Street Cleveland 14, Ohio

Bulletin 15-B gives complete information. Write!

BUCKEYE
"FOR THAT EXTRA SERVICE
SILICA FIRESTONE

Look at that detail

THERE is detail to look at when you use Krause Truscor or Amerikor Cereal Binders in the making of your cores.

Added to a core mix, Truscor and Amerikor give a better surface finish . . . more accurate handling of detail.

Accuracy of detail results from greater flowability. Extra green strength, improved collapsibility, faster operations, less wastage — these are other advantages of these superior cereal binders made from corn.

Specify Krause Truscor or Amerikor on your next order — Truscor if you like a light-weight binder; Amerikor, if you prefer a heavier mixture.

CHAS. A. KRAUSE MILLING CO., MILWAUKEE 1, WIS.
World's largest millers of dry corn.

Truscor AND **Amerikor**
(Light Weight) (Heavy Weight)

CEREAL BINDERS

DISTRIBUTORS

M. A. Bell Co., 3430 Brighton Blvd., Denver, Colo.
M. A. Bell Co., 401 Velasco St. Houston, Texas
M. A. Bell Co., St. Louis 2, Mo.
A. L. Cavedo & Son, Inc. Richmond 21, Va.

Foundry Supplies Co. Chicago 16, Ill.
J. H. Hatten, Lansdowne, Pa.
Independent Foundry Supply Co., Los Angeles 11, Calif.
Joseph B. Meier, 96 N. 18th St., East Orange, N. J.

Marthens & Co., Moline, Ill.
Carl F. Miller & Co. Seattle 4, Wash.
Milwaukee Chaplet & Mfg. Co., Milwaukee 4, Wis.
Pacific Graphite Works Oakland 8, Calif.

Porter-Warner Chattanooga 2, Tenn.
Smith-Sharpe Co. Minneapolis 14, Minn.
Frederic B. Stevens, Inc. Buffalo 12, N. Y.

Frederic B. Stevens, Inc. Cleveland 14, Ohio
Frederic B. Stevens, Inc. Detroit 26, Mich.
Western Industrial Supply Co. 208 S. E. Hawthorne Blvd. Portland 14, Oregon

FASTER CUTTING

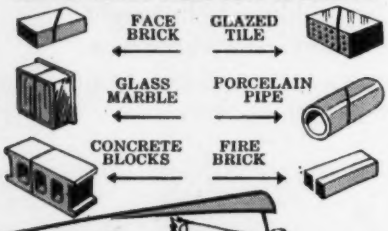
WET or DRY with the NEW HD 48 CLIPPER Masonry Saw

You'll be amazed how quickly and easily you can cut virtually any special length or shape from the hardest masonry materials. Clippers save time — save material, assure better workmanship on every job.

With the exclusive Clipper design, proven throughout the world and guaranteed to provide the fastest cutting speed and the lowest cutting costs.

DUSTLESS MASONRY CUTTING so fast and easy. Just turn on the circulating water system and slice through the hardest masonry materials. Foot Pedal control for varying material sizes or lock the cutting head at a set position, whichever is desired.

CLIPPER MAKES THESE CUTS IN SECONDS



FREE TRIAL
In keeping with our policy for the 10th consecutive year, you can have a Clipper on Trial. Clippers for Every Job priced as low as $195... write for Catalog, Today!

THE CLIPPER MFG. CO.
2814 WARWICK • KANSAS CITY 8, MO.
PHILADELPHIA CLEVELAND ST. LOUIS AUSTIN, TEX.

ABSTRACTS

The following abstracts have been prepared from current technical and trade publications. Photostat copies of the complete articles can be obtained from the Engineering Societies Library, 29 W. 39th St., New York.

Foundry Pig Iron

GAS CONTENT DETERMINATION. J. E. Hurst and R. V. Riley, "A Study of the Hydrogen, Oxygen, and Nitrogen Contents of Foundry Pig Iron," *Journal of the Iron and Steel Institute*, vol. 159, part 2, June, 1948, pp. 130-136.

Summary of a survey of the residual contents of hydrogen, oxygen, and nitrogen in different types of British foundry pig irons. The vacuum-fusion method was used to determine the gas contents. The compositions of the specimens were determined by both chemical and spectrographic analysis.

A complete range of specimen fractures of a typical foundry iron prepared in 1945 was examined and compared with results of the same brand made twenty-five years earlier. Other irons were in some cases presumably taken from stock piles.

The vacuum-fusion apparatus with modifications of special interest to the analysis of pig iron is described briefly. The gas analyses are reported in parts per million as well as the usual percentage method. The authors believe it to be a more accurate expression of the minute quantities of some gases to be found in the pig iron.

The spectrographic method of analysis had been described by the authors in the *Journal* in 1946, part 2, p. 133. The normal spark technique was adopted for the estimation of nickel, chromium, copper, vanadium, and titanium. The semi-quantitative D. C. arc method was used for all other trace elements.

Carbon, silicon, sulphur, phosphorus, and manganese were determined by the chemical method. The Strohlein volumetric combustion carbon apparatus was used. Sulphur was analyzed by the high-temperature oxygen-combustion method. Other elements were determined by well known chemical procedures. Results are given in tabular form.

Results of the survey show a considerable variation of total gases; a possible ratio between hydrogen and oxygen contents; and very little variation in the nitrogen content. The metallurgical significance of these results is still unknown.

Permanent Molds

CASTING COPPER BASE ALLOYS. James L. Erikson, "A Review of British Practice—Permanent Mold Casting of Copper Base Alloys," *Iron Age*, vol. 162, no. 4, July 22, 1948, pp. 84-89.

Current British practice in casting copper base alloys in permanent molds is reviewed in this article.

(Continued on Page 90)

RADIANT Since 1879 FACINGS

BILL GAGGER says:

They're New!! They're Better!!

RADIANT LIKWIPART

For all metal pattern production work. More and cleaner lifts per application. Fast drying. Leaves a polished finish on the pattern. A little goes a long way.

RED BALL
•
LIQUID PARTING

An oily base type liquid parting. Fine for sand slinger and plaster molding work. Stays in perfect solution.

DUXBAK

As waterproof as a duck's back, yet swabs easily. Clean lifts and meets all insurance and state industrial requirements.

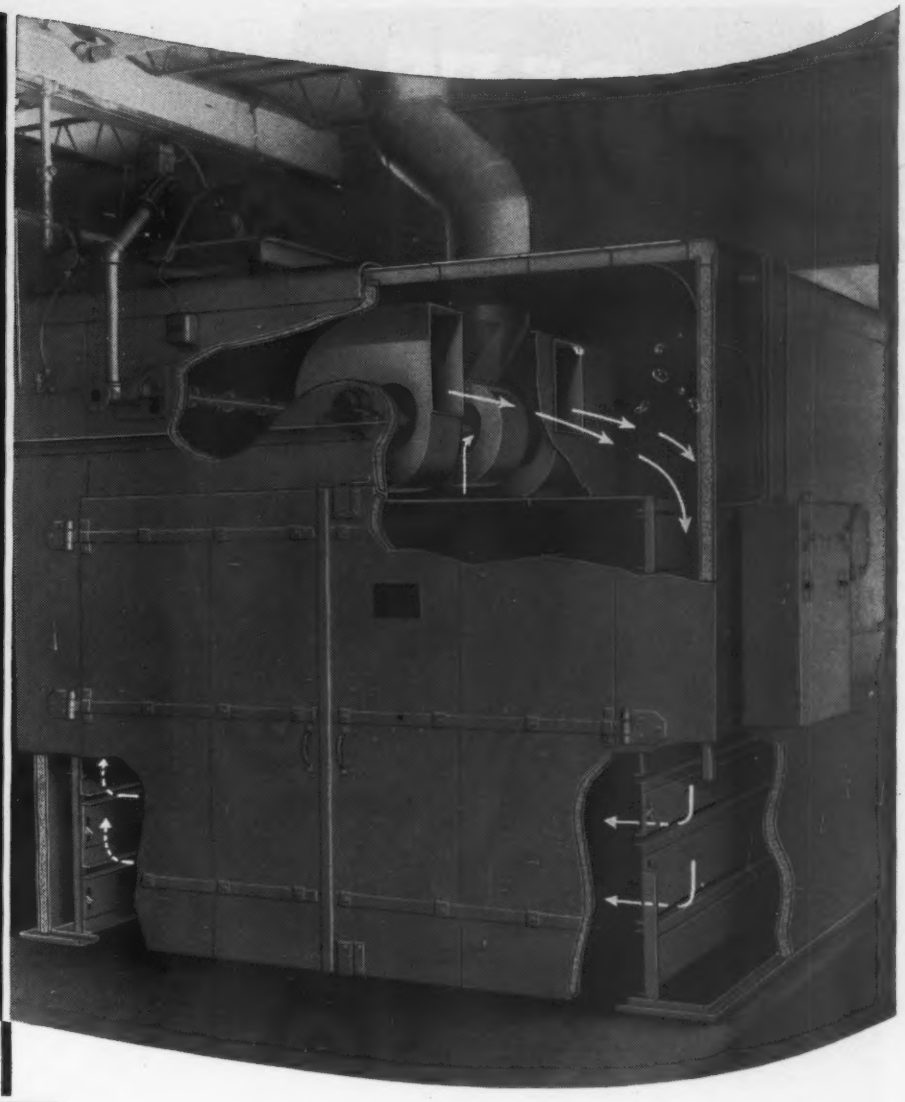
• • •

Samples of any, or all of these will convince you.

The Smith Facing & Supply Co.
1857 Carter Rd., Cleveland, Ohio

The Well Designed Industrial Oven

does a better job at less cost



This batch type oven used equally well for core, insulation, paint and grinding wheel baking—also low temperature heat treating, plastic curing and other processes, is a compact, self-contained unit. Recirculating heaters and exhaust fans are integral parts of the oven assembly for maximum heat conservation, greatest economy of plant space and better appearance. Note they are entirely within the oven frame.

Although gas heating is illustrated here, any other type of heating is equally applicable.

A single drive motor operates both recirculating and exhaust fans for maximum power saving.

A positive movement of heated air across the work space assures uniform baking temperatures throughout the entire load and maximum baking efficiency.

Field installation is greatly facilitated by the use of a completely wired operating control panel. All operating and control parts are readily accessible for inspection, service or adjustment.

• • • •

Consult a Young Brothers Engineer before deciding on any industrial oven equipment.

5099

Young Brothers Co.

6500 MACK AVENUE • DETROIT 7, MICHIGAN

YB CO

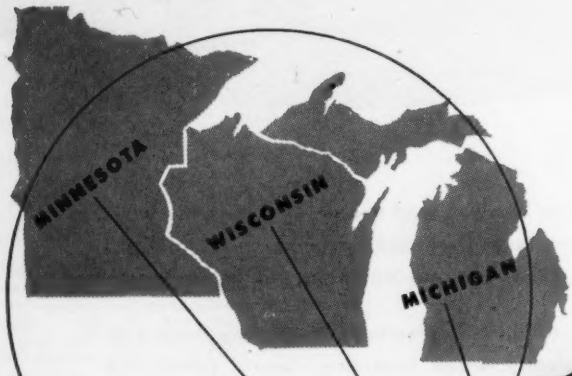
LADLES

• ALL CAPACITIES
• ALL TYPES *Including*
TIMKEN WORM GEARED LADLES

LADLES • BOWLS • SHANKS • SPECIAL EQUIPMENT • TONGS • BAILS

Catalog Available

Industrial EQUIPMENT COMPANY
115 N. OHIO ST. • MINSTER 1, OHIO



Serving this Area

FOUNDRY SANDS • BONDING CLAYS • STEEL ABRASIVES

CARPENTER
Brothers Inc.
606 W. WISCONSIN AVE., MILWAUKEE 3, WIS.
FOUNDED IN 1917

ABSTRACTS

(Continued from Page 88)

The various aluminum bronze alloys are discussed in regard to chemical composition and mechanical properties. The British base their choice of the particular alloy on a consideration of the casting size, weight and design.

Brasses are preferred to aluminum bronze. The author notes that H. K. Barton, outstanding British casting authority, states that all alpha-beta brasses can be cast successfully in permanent molds. The choice of brass depends upon the application rather than on castability.

Typical composition of basic copper-base permanent mold alloys is given, and the temperature range for some of the alloys is given in another table.

Among the recommendations and cautions of the British casters for the handling, processing, and casting of copper-base alloys are:

Use raw materials of high purity;
Do not retain casting alloys in the molten state for long periods;
Deoxidize the copper, in preparing aluminum bronze, before adding aluminum;
Avoid agitation of melt during melting to minimize formation of oxides;
Avoid turbulence when pouring to guard against cold shuts, folds and seams;
Use adequate feeding heads and risers to combat high shrinkage.

Die coatings vary with each caster, the object being to insulate the die from the casting metal in varying degrees in order to arrive at the desired rate of cooling. All casters agree that dies should never be water cooled.

The majority of casters believe in close temperature control. Dies are preheated in ovens. This insures uniform heat throughout the process at the desired operating temperature.

Aluminum Alloy Castings

AUTOMOTIVE DESIGN. D. F. Toot, "Automotive Designer's Concept of Steel vs. Light Metal," *S.A.E. Journal*, Aug. 1948, vol. 56, no. 8, pp. 59-62.

Cost and ease of manufacture are basic factors in designing for use aluminum and alloys in automobiles. Aluminum can be used for any part designed due to the achievements of production men during the recent war.

The article explains the importance of considering yield strength, strength at elevated temperatures, and thermal expansion in design. Comparisons between the various mechanical properties of as-cast and heat-treated aluminum alloys are made, as well as between sand castings, die castings, and permanent mold castings.

Relative strength, notch sensitivity, and endurance of aluminum alloys and cast irons are compared. Under thermal expansion the article discusses the use of steel bolts to fasten aluminum parts, and steel inserts. Corrosion of bimetallic joints requires that the two different metals be insulated from each other or from solutions of electrolytes.

Throw Away Your Sand Shovels

It's Here!

The ROYER SELF-LOADING SAND CONDITIONER

IT'S COMPLETELY MECHANIZED, SELF-LOADING, SELF-PROPELLED!

Goodbye to hand labor in the sand preparation department! One man at the variable speed controls of your Royer Self-Loader can take care of your entire sand preparation . . . scooping up sand while moving into the heap . . . automatically culling out trash . . . combing, blending, aerating, and discharging top grade molding sand. And the speed of operation will be a real surprise—up to 50 tons per hour.

Let us send you full details about this revolutionary new Self-Loading Sand Conditioner. Write for detailed information.

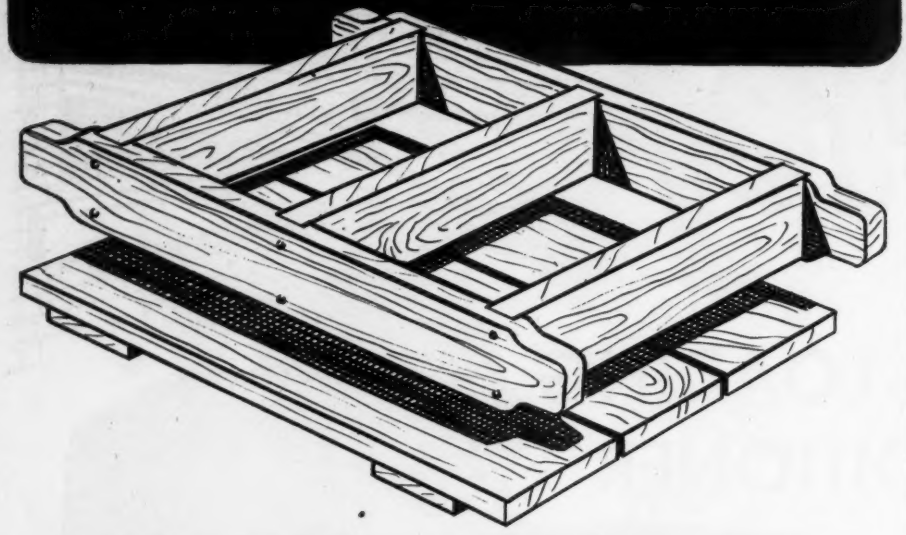
ROYER

FOREMOST IN SAND CONDITIONING EQUIPMENT

ROYER FOUNDRY & MACHINE CO.

155 PRINGLE ST., KINGSTON, PA.

FLASK LUMBER BOTTOM BOARDS



SPECIAL LUMBER AND FABRICATED WOOD PRODUCTS FROM DOUGHERTY LUMBER

Flask lumber or completed flasks, cut to specifications. Any dimension, any type—built to your own particular requirements.

- **BOTTOM BOARDS that stand up under rough, continuous service. Standard and special sizes.**
- **FILLETS, feather-edged to save time. 1/4" to 2" size, three-foot lengths.**
- **DOWELS of sturdy hardwood, from 3/16" diameter.**
- **CRATING LUMBER, in random lengths or cut to size.**
- **PALLETS, made to order...made to simplify your "moving" jobs.**
- **ROLLERS to make the movement of "big stuff" a simple operation.**
- **SKIDS, in special and stock sizes.**
- **BENCHES built to your specification. Steel legs, working surface of maple flooring.**
- **TOTE BOXES, in any size and any design you require.**

CALL YOUR LUMBER NUMBER, DIAMOND 1200, FOR OVER-THE-PHONE OR PERSONAL HELP FROM LUMBERMEN WHO KNOW FOUNDRY-PROBLEMS!

Mid-America's Largest Lumber Supplier!

DOUGHERTY LUMBER COMPANY

CLEVELAND 5, OHIO — DIAMOND 1200

FIRM FACTS

Fairchild Engine & Airplane Corp., New York City, has concluded a licensing agreement with **Wellworthy Piston Rings, Ltd.,** of Lymington, Hants., England, covering use of Fairchild's process for bonding aluminum to iron, steel and other metals. Wellworthy has a large aluminum foundry in Lymington which will enable it to cover the European and Colonial market.

Allis-Chalmers Mfg. Co.'s net earnings for the second quarter of 1948 totalled $3,793,723, or the equivalent of $1.39 per common stock share.

Standard Car Sales, Inc., 332 S. Michigan Ave., Chicago, has been named railroad sales agency for the **Automatic Transportation Co., Chicago.** Standard Car Sales will act for Automatic with railroads maintaining purchasing offices in Oklahoma, Kansas, Iowa, Michigan, Indiana, Ohio, West Virginia, Wisconsin, Kentucky, and Illinois.

Pacific Car & Foundry Co. recently received a highly favorable report in West Coast newspapers when a touring group from the San Francisco Stock Exchange, accompained by newsmen, visited its Renton, Wash., plant. The plant specializes in the casting of cast iron crank shafts for marine diesel engines and for diesel locomotives. Riding in a bus manufactured by Pacific Car & Foundry, the party also visited the company's Kenworth Division at Seattle as part of a four-day tour of West Coast industries.

Permanente Products Co., Oakland, Calif., announces the opening of a Chicago office to handle its refractory products. The office will be headed by Charles R. Gebel, formerly a research engineer with Jones & Laughlin, Pittsburgh.

Sales headquarters of the **Baltimore Foundry & Machine Corp.** have been transferred from Baltimore to the firm's parent organization, the McConway & Torley Corp., Pittsburgh, Pa.

Chain Belt Co., Milwaukee, announces the opening of a new district sales office at 2900 W. Clay St., Richmond, Va. Fred W. Taylor will be district manager.

F. W. Berk & Co., Inc., New York City, for many years a producer of mercury and mercurials, will henceforth add zirconium products to its line. Using raw materials from its plant in Australia, Berk is producing zirconium products at its plant in Wood Ridge, N.J., where complete facilities for the production of all types of zirconium compounds are being set up. Zircon sand in granular form and experimental quantities of other zirconium salts are currently available.

Sperry Products Inc., formerly of Hoboken, N.J., has moved to its new home

(Continued on Page 94)

Quantity
PRODUCTION
of
GREY IRON CASTINGS

*

ONE OF THE NATION'S
LARGEST AND MOST MODERN
PRODUCTION FOUNDRIES

*

ESTABLISHED 1866

THE WHELAND COMPANY

FOUNDRY DIVISION

MAIN OFFICE AND MANUFACTURING PLANTS

CHATTANOOGA 2, TENNESSEE

● ALUMINUM
● BABBITT ● BRASS
● BRONZE ● DIE CAST ALLOYS
● LEAD ● SOLDERS
● ZINC ● ALLOYS

Producers of

CONSUMER'S | Scrap Metals | By Products | Residues

VIENER METALS

FOUNDED 1907

HYMAN VIENER & SONS

RICHMOND, VA.
WASHINGTON, D. C. ● CHARLES TOWN, W. VA.

★ Sharper Castings
★ Greater Brinell Hardness
★ Increase Tensile Strength
★ Increase Transverse Strength
★ Increase Wear Resistance
★ Increase Heat Resistance

Copper Shot

IMPROVES YOUR IRON

ALTER COMPANY Fifty Years of Service

1791 Rockingham Road, Davenport, Iowa

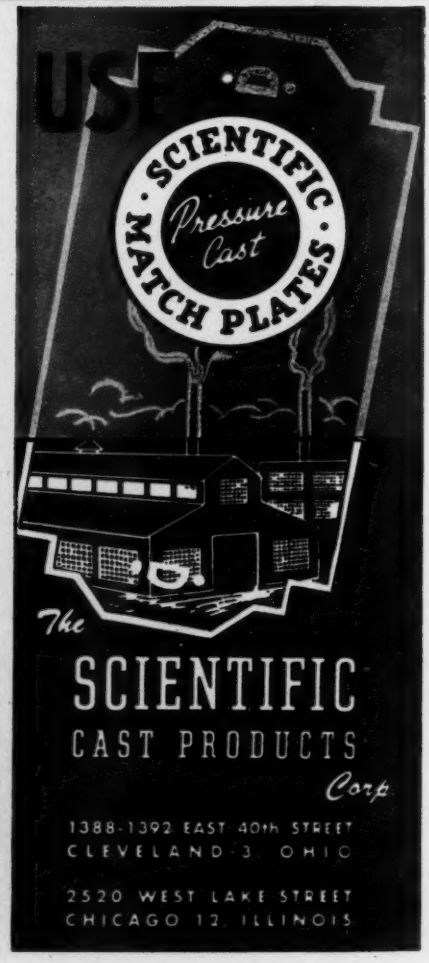
Do You Know?

You can prevent CORE BURNING, VEINING AND PENETRATION with . . .

TAMMS No. 90 IRON OXIDE

Write! Learn how you too can prevent core sand failures, improve castings, reduce cleaning costs!

TAMMS SILICA CO.
228 N. La Salle St., Chicago 1, Ill.



The SCIENTIFIC CAST PRODUCTS Corp.

1388-1392 EAST 40th STREET
CLEVELAND 3, OHIO

2520 WEST LAKE STREET
CHICAGO 12, ILLINOIS

FIRM FACTS

(Continued from Page 92)

offices and plant at Danbury, Conn., and is now in full production of its products—electrical and ultrasonic instruments for detecting defects in materials, hydraulic remote controls, and rail service for testing rail in track for internal defects—at its new location.

Wheelco Instruments Co. has opened a new sales office at 138 E. Becher St., Milwaukee. M. A. Embertson, formerly sales engineer at the company's Chicago office, will be in charge of the Wisconsin office.

Howard Foundry Co. of Chicago recently purchased the magnesium foundry formerly owned by Dalmo-Victor at Belmont, Calif. The new plant, the sixth in the Howard foundry family, is ultramodern and has produced a large percentage of the magnesium incendiary bombs and aircraft parts used in World War II. William G. Brown has been made sales manager of this and the other five Howard plants. He was formerly sales manager of the Werra Aluminum Co., and more recently, Chicago District Manager for Bohn Aluminum & Brass Corp. for 14 years.

Great Lakes Foundry Sand Co.'s newly-completed drying plant at Bank Sand, near Vassar, Mich., is now in full operation. Of all steel contruction and embodying the latest developments in drying and screening processes, the plant is capable of handling upwards of 30 tons per hr. The company owns and operates its own locomotive to facilitate operations.

Plans for a large new research laboratory for investigation of aluminum production problems have been announced by **Aluminum Laboratories Ltd.,** subsidiary of Aluminum Ltd. To be built at Arvida, Que., the new laboratory will include a pilot production plant. The building, to be completed in 1949, and equipment are expected to cost about one million dollars.

Two other laboratories operated by Aluminum Laboratories Ltd.—at Kingston, Ont., and at Banbury, England—are primarily concerned with semi-finished and finished products. The new laboratory will concentrate on production problems such as chemical treatment of basic ores, and the reduction of the light metals from their oxides.

Whiting Corporation's shareholders at their annual meeting July 22 re-elected the following directors: Gen. T. S. Hammond, S. H. Hammond, John Munro and J. C. Thomas—all associated with the Whiting Corp.; and Col. John Slezak, president, Turner Brass Co.; John B. Dunbar, president, John Dunbar & Co.; and John W. Cavanaugh, partner of the Corporation's counsel, McDermott, Will & Emery. T. S. Hammond was elected chairman of the board and S. H. Hammond, president. All other officers were re-elected. The Corporation's annual report to its shareholders pointed out that the fiscal year ending April 30, 1948, was the most successful in its history.